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Soil Survey
of
Chemung County, New York

By

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SOIL SURVEY OF CHEMUNG COUNTY, NEW YORK

By C. S. Pearson, in Charge, W. W. Reitz, John Mack, Ward Ellsworth, and James Schwartz, Cornell University Agricultural Experiment Station

INTRODUCTION

Chemung County is situated within the southwestern plateau section of New York, which in reality is the northern extension of the uplands along the western base of the Applachian Mountains. The plateau has been greatly dissected to depths ranging from 600 to 900 feet. The extreme elevation is 1,900 feet above sea level, and the average elevation of the uplands is between 1,600 and 1,800 feet. The valley of Chemung River crosses the southern part of the county and ranges from 1 to 3 miles in width.

The climate is continental and is characterized by cool summers and long moderately cold winters. The average annual precipitation is 32.81 inches, more than 50 percent of which falls during the 156-day frost-free season. The climatic conditions are favorable to the system of agriculture commonly practiced, which consists largely of the production of hay, pasture, and feed for dairy cattle.

The county is underlain by interbedded shales and sandstones laid down during the Devonian period and represented by the Chemung and Portage groups. It is from these rocks that most of the glacial till which covers the county is derived. This mantle of till is thin on the higher elevations and thicker on the slopes. Much of the material in the valleys, although indirectly the result of glaciation, was deposited through the action of water and is characterized by assorting and stratification. The water-laid material contains a larger proportion of constituents brought in from regions a considerable distance to the north than the ice-laid drift. These foreign materials consist of crystalline and limestone gravels.

On the basis of their topographic position the soils are broadly grouped into upland soils and valley soils. They are further classified on the basis of drainage and reaction.

The only well-drained members of the upland group are the Lordstown soils. The thin mantle of glacial till, from which these soils have developed, has been derived entirely from the local underlying rocks, with a predominance of sandstone. They occupy the highest elevations and steep slopes, and they are shallow and acid. They are moderately productive for the crops common to the upland section, as hay, small grains, and buckwheat. The smoother areas of the Lordstown soils are the best of those in the hill section for potatoes.

The imperfectly drained upland soils, represented by the Mardin, Canfield, and Langford soils, are characterized by light-colored surface soils underlain by mottled moderately compact subsoils. The first two mentioned are noncalcareous, and the last has an alkaline subsoil. All three have been derived from deep deposits of glacial

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till. Timothy and clover hay, oats, buckwheat, and silage corn are the important crops produced. A considerable proportion of the farms on these soils has been abandoned.

The poorly drained upland soils include the second most extensively developed series of soils in the county, the Volusia. In the same class, but limited in extent, are the Fremont and Erie soils. The latter has an alkaline subsoil; the first two mentioned are acid throughout. Like the imperfectly drained soils, these soils have light-colored surface soils underlain by hard compact mottled subsoils. The degree of compaction, however, is much greater in the soils of this group. The same crops are grown, but yields are not so high, and the percentage of farm abandonment is greater. These soils also have been derived from deep deposits of glacial till.

The well-drained valley soils derived from ice-laid deposits occupy an intermediate position between the valleys and the uplands. They are represented by soils of two series—the Wooster and the Lansing. The Wooster soils are acid throughout, and the Lansing soils have calcareous subsoils. These are good agricultural soils but are not present in large areas. They have developed from glacial till deposits containing a mixture of materials.

Valley soils, developed from materials deposited by the action of water, include those soils derived largely from products of the local rocks and those representing a mixture of local and foreign materials. The latter, brought in from the north, are composed of crystalline and limestone gravel. These soils, because of their good physical condition and open subsoils, are productive for a wider range of crops and yield considerably more than the members of the upland group. They have also been classified on the basis of characteristics due to differences in drainage and reaction.

The well-drained valley soils derived from the old water-laid deposits include soils of the Howard and Chenango series. They are characterized by stratified gravel and sand subsoils; the Howard soils are alkaline below a depth of 36 inches, whereas the Chenango soils are acid throughout. The Dunkirk soils, derived from lake-laid sediments and having gravel-free stratified silt and clay subsoils, are also well drained. The soils of the first bottoms and low terraces of the Chagrin and Tioga series are developed from well-drained recent alluvium, the Chagrin being alkaline and the Tioga acid. All these soils occupy level or undulating terrace positions and are adapted to a wide range of crops.

Imperfectly drained valley soils are the Caneadea, Eel, and Middlebury. The Caneadea soils are derived from lake-laid sediments, and the Eel and Middlebury soils from recent alluvial deposits. The Caneadea and Eel have alkaline subsoils, whereas the Middlebury soils are acid throughout.

The poorly drained soils occurring in the valleys are the alkaline Wayland soil and the acid Holly soil, both of which are too wet for agricultural use except as pasture.

The farms are predominantly of the dairy type, and practically all the arable land is devoted to crops necessary for this type of farming. Moreover, the physical properties of the upland soils limit the crops which can be successfully produced to hay, small grains, and corn for silage.

Some tobacco is grown on the soils of the terraces and first bottoms. The acreage of this crop, however, is decreasing. In the vicinity of Elmira, a few acres are devoted to vegetables and small fruits, all grown for local consumption.

COUNTY SURVEYED

Chemung County is in the south-central part of New York, the Pennsylvania-New York State line forming the southern boundary (fig. 1). The county is nearly square and has a land area of 407 square miles, or 260,480 acres. Elmira, the county seat, is 149 miles southeast of Buffalo and 104 miles south of Rochester.

The county lies entirely within the southwestern plateau section of the State, which represents the northern extension of the great upland region lying along the western base of the Appalachian Mountains. The plateau has been so dissected and eroded that the only existing evidence that the land was once flat is found in the unusually uniform elevations of the hilltops.

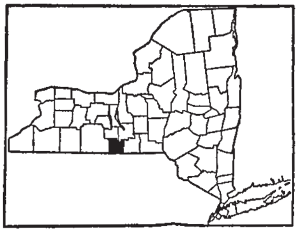


FIGURE 1.—Sketch map showing location of Chemung County, N. Y.

The most prominent physiographic feature is the valley of Chemung River, which ranges in width from one-half to 3 miles.

The preglacial drainage of the country now comprising Chemung County was to the north, the Susquehanna River uniting with the Chemung at Horseheads and flowing due north from this point. During the retreat of the ice, the valleys were choked with drift, causing the waters to seek a southern outlet. The Susquehanna turned south at Waverly. The Chemung was diverted at Big Flats, cutting a new channel from this point to Elmira where it again entered the old valley. The old valley is strikingly evident from Big Flats to Horseheads and from Elmira north to the same point.

The land has been so severely dissected that the upland part has a strongly rolling surface relief. The depth of dissection is greatest along Chemung River where the difference in elevation between the valley floor and the adjacent hilltops ranges from 600 to 800 feet. The tributary valleys are not so deeply eroded. They vary in depth of dissection, according to the size of the stream, from 200 to 500 feet. The slopes of the valleys, although smooth for the most part, are steep. The areas of maximum elevation occur less than 1 mile back from the valleys.

The elevation at Big Flats on the western boundary of the county is 900 feet above sea level; at Elmira, 840 feet; and at the point where Chemung River leaves the county in the southeastern corner, 775 feet. The hilltops of the upland section have rather uniform elevations ranging from 1,500 to 1,800 feet. The point of maximum elevation, 1,902 feet, is in the northwestern corner of the county.

Practically the entire county lies in the Susquehanna drainage basin. A narrow strip, extending from Horseheads north to the county line, lies in the Ontario basin, the waters flowing into Seneca Lake through Catharine Creek.

Chemung River enters the west-central part of the county and flows southeast, leaving in the extreme southeastern corner. The principal tributaries are Seely Creek, flowing north from Pennsylvania and entering Chemung River a few miles below Elmira, and Newtown Creek, draining part of the northern section, entering the Chemung at Elmira. Most of the streams flow from north to south. Surface drainage is sufficiently adequate to remove all surplus water. Floods are infrequent through the Chemung Valley.

The county lies in the Appalachian forested belt. Before the advent of the white man, this section of the State was covered with dense forests of white pine and hardwoods, the latter including associations of sugar maple, beech, hickory, yellow birch, and, in the wetter situations, hemlock. On the high ridges chestnut, pitch pine, red oak, and scarlet oak grew. In the valleys on the bottoms and terraces elm, sycamore, white ash, red maple, and hickory were common trees. The white pine forests were dense and in many places formed pure stands. Although the hardwood forests were also dense, they contained many shrubs and much undergrowth, the more common of which were bunchberry, arrowwood, dogwood, laurel, and wintergreen.

All the original forests have disappeared. The present forests are second- and third-growth hardwoods of the species listed, with the exception of chestnut, which is entirely absent. Very little white pine is found at present, although where seed trees have been left it seems to reproduce readily.

The grant of land made by the English Government to New York covered a part of the grant made to Massachusetts. A compromise was effected in 1786, which gave Massachusetts the right of purchasing from the Indians practically the whole of New York State west of Seneca Lake. The " Genesee Country ", as this section was called, contained more than 6,000,000 acres. This tract was sold by Massachusetts to Phelps and Gorham for $1,000,000, but they, being unable to meet their payments, surrendered the greater part of the purchase and sold the remainder, 1,200,000 acres, to Robert Morris, of Philadelphia. Included in the tract sold to Morris was a large part of the present Chemung County. Another tract granted by New York to Massachusetts was known as the " Boston Ten Towns." It included land that now comprises Broome, Tioga, and part of Chemung County. This tract was sold to John Brown and others.

Chemung County was formed from Tioga County in 1836. In 1845, it suffered its first and only diminution of territory when the northern part was taken to form part of Schuyler County. The name, Chemung, is taken from Chemung River and is said to signify " big horn " or " horn in the water ", owing to the finding by the Indians of a tusk of a mammoth in the river. Throughout the entire time that the red man occupied this part of the country, the valley of the Chemung was one of their great thoroughfares.

Previous to the Revolution, the Indians had learned something about agriculture from the French. When General Sullivan invaded the region in 1779, he found Indian lands that had been cultivated for years. The orchards showed years of growth, and the variety of products gave evidence of the practice of an agricultural knowledge far in advance of that possessed by the Indians in other sections.

The Indians were defeated by Sullivan's army at Newton (now Elmira). This campaign marked the end of Indian domination in the valley and allowed settlement by whites. The first permanent settlement was made in 1786 by eight men who came up the Susquehanna and Chemung Rivers and settled along Wyncoop Creek. Other men, who had accompanied Sullivan on his expedition, came from the New England States the following year. After the New York Legislature had passed laws favorable to settlers, newcomers from eastern New York, Pennsylvania, and New Jersey arrived at a rapid rate during the next 20 years. This was largely owing to reports concerning the fertile soils of the valley and the large crop yields to be obtained. Besides wheat and Indian corn, other important products were maple sugar, fat cattle, and apples. Agricultural development was rapid, and in 1803, from 40,000 to 50,000 bushels of wheat annually were sent to market down the Susquehanna River.

More than 95 percent of the farmers are native-born whites, practically all descendants of the original settlers. The 1930 census gives the population as 74,680, 52,458 of whom are urban residents and 22,222 rural. The rural population is further classified as 15,229 nonfarm and 6,993 farm residents. The number of people has increased steadily since the formation of the county, and since 1880, the urban population has exceeded the rural. Elmira, the county seat and only city has a population of 47,397. Other important towns are Elmira Heights, with a population of 5,061; and Horseheads, with 2,430. These three places, all within a radius of 6 miles, account for more than 73 percent of the total population.

Railroad transportation facilities are good. The main lines of the Erie Railroad and of the Delaware, Lackawanna & Western Railroad pass through the county. A branch of the former extends south from Elmira into Pennsylvania. The Pennsylvania Railroad passes through Elmira and extends northward, and the Lehigh Valley Railroad serves the eastern part of the county. There are 423 miles of improved roads in the county, consisting of 106 miles of State highways, 118 miles of county roads, and 199 miles of town roads. Unimproved dirt roads total 472 miles.

The 1930 census records 1,565 farms, 558 of which are located on hard-surfaced roads, 81 on graveled roads, 145 on improved dirt roads, and 725 on unimproved roads.

According to the 1930 census, 710 farm homes are supplied with telephones, 530 are lighted by electricity, and 486 have water piped into the dwelling house.

The city of Elmira offers excellent educational facilities. Elmira College, the first institution of higher learning for women in the United States, is located here. The majority of the rural schools are one-room structures, as little consolidation of rural schools has taken place.

Elmira owes its growth to the industrial development that has taken place within its limits. A variety of products are manufactured, the more important of which include fire trucks, automobile parts, machine parts, bridge steel, and silk products.

CLIMATE

The climate is typical of that of southwestern New York. It is characterized by rather long winters, with occasional periods of extremely cold weather. Spells of mild weather are not uncommon during the winter. The minimum temperature recorded by the United States Weather Bureau for this season is −24° F., and the maximum is 67°, a range of 91°. The mean temperature for the winter months is 26.8°.

The mean summer temperature is 69.4°. The highest recorded for this period is 102° and the lowest 32°. The range between the summer and winter temperature extremes is 126°. The average date of the last killing frost is May 3 and of the first is October 6, giving an average frost-free season of 156 days, which is ample for the maturing of all crops commonly grown.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Elmira, Chemung County, N. Y.*

[Elevation, 863 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1930)	Total amount for the wettest year (1860)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December	29.2	66	−12	2.06	1.77	1.48	9.6
January	25.4	67	−24	2.04	1.67	2.35	8.0
February	25.9	65	−19	1.63	1.37	2.50	9.8
Winter	26.8	67	−24	5.73	4.81	6.33	27.4
March	34 5	86	−3	2.31	3.24	5.99	9.8
April	46.6	89	6	2.95	2.00	4.81	2.5
May	58.2	95	24	3.75	3.29	7.73	(1)
Spring	46.4	95	−3	9.01	8.53	18.53	12.3
June	67.4	99	32	3.93	4.18	4.10	.0
July	71.8	101	41	3.17	1.87	3.90	.0
August	69.1	102	40	3.31	.50	6.45	.0
Summer	69.4	102	32	10.41	6.55	14.45	.0
September	62.8	102	28	3 04	2.44	2.50	.0
October	51.1	93	18	2.74	1.19	5.20	(1)
November	39 8	80	10	1.88	.62	3.70	1.7
Fall	51.2	102	10	7.66	4.25	11.40	1.7
Year	48 5	102	−24	32.81	24.14	50.71	41.4

1 Trace.

Table 1, compiled from records of the United States Weather Bureau station at Elmira, gives the more important climatic data for the county.

These figures are taken from the United States Weather Bureau station records at Elmira which is situated in a broad valley at an elevation of 863 feet. The surrounding upland country lies at an elevation ranging from 500 to 800 feet higher. Although no records are available for the upland section, it is evident that the growing season is shorter by 2 or 3 weeks and that the precipitation is somewhat greater.

The annual precipitation has ranged from 24.14 inches in 1930, the driest year on record, to 50.71 inches in 1860, the wettest year. The mean annual precipitation is 32.81 inches, 52 percent of which falls during the growing season, from May to September, inclusive. June, July, and August are the months during which the heaviest rainfall occurs.

The ground usually freezes during November and remains frozen, thereby prohibiting any plowing during the winter. No winter crops are grown. Winter wheat was formerly an important crop, but its production has been discontinued.

AGRICULTURAL HISTORY AND STATISTICS

The earliest agriculture of the area comprising Chemung County was carried on by the Indians and had reached a comparatively high stage of development at the time of Sullivan's invasion. The farming operations of the Indians were carried on throughout the Chemung Valley on the river flats, and fruit, corn, beans, pumpkins, and squashes were the principal crops grown. The orchards destroyed by Sullivan's men showed years of growth.

The early white settlers cultivated the fields deserted by the Indians, planting them to corn and wheat, which at first were the only crops grown. The early agriculture was carried on only in the valleys, as the upland sections were covered with vast forests. The lumber industry, which became important about 1820, received a great impetus on the completion of the Chemung Canal in 1832. After the uplands were cleared, livestock raising developed into an important industry, especially the production of cattle and sheep. A census of 1840 records the following numbers of livestock: All cattle, 21,406; sheep, 37,975; and swine, 18,110. During the same year, there were produced 192,831 bushels of wheat, 203,184 bushels of oats, and 120,732 bushels of corn. During 1840 there were in operation 166 sawmills and 27 gristmills, which produced products valued at $162,753 and $185,840, respectively.

The completion of the Erie Railroad between Buffalo and New York, in 1851, gave a second impetus to farming and gradually brought about a change in the system of agriculture. The rapid transportation offered by the railroads made it possible to market butter and cheese to advantage, consequently dairying soon became the leading agricultural industry and has remained so.

From 1850 to the present, the trend in agriculture has been from a grain and livestock system to one in which dairying and cash crops are the most important items. The numbers of sheep and beef cattle have decreased, whereas the number of dairy cattle has increased. The acreages devoted to wheat and corn have decreased, and the area given over to forage production has increased. Tobacco growing developed to an industry of importance, but it has declined since 1900. Poultry production has become increasingly important since 1850.

During 1930, the number of cattle on farms in Chemung County was 16,267, of which 9,926 were cows and heifers used for milk production. The total quantity of milk produced in 1929 amounted to 5,769,817 gallons, nearly 75 percent of which was sold as whole milk. Holstein-Friesian is the most popular breed of dairy cattle, followed

by Guernsey and Jersey. There are only a few herds of the last two breeds, however.

In 1930 census returns reported a total of 3,004 horses on farms. All the larger and more progressive farms have an average of 3 horses, or 1 team and a tractor. All the horses are shipped in from the Middle West, and a good 1,300- to 1,600-pound team costs from $250 to $300.

Sheep decreased in numbers between 1900 and 1920, but since 1920 there has been a slight increase. The abandonment of many farms has meant a greater acreage available for pasture. Practically all the sheep are Downs or various crosses of these breeds.

Swine have never been of great importance, as there is not enough grain, especially corn, produced to make profitable the raising of hogs on a very large scale. Many farmers raise and fatten a hog or two on refuse from the house, and the hogs are slaughtered in the fall for home consumption.

The raising of poultry has steadily increased in importance. During 1929, 1,395,245 dozens of eggs were produced and 1,161,941 dozens were sold. During the same year 122,768 chickens alive or dressed were sold. Ducks, geese, and turkeys are comparatively unimportant. Nearly every farm maintains a flock of chickens ranging in numbers from 100 to 300. After supplying home needs with poultry products the surplus is sold locally or shipped by truck to New York City.

Table 2, compiled from records of the United States Bureau of the Census, gives the number and value of domestic animals on the farms of Chemung County in stated years, and table 3 gives the value of the principal agricultural products in 1929.

TABLE 2.—*Number and value of domestic animals on the farms of Chemung County, N. Y., in census years*

Year	Horses		Cattle		Swine		Sheep		Chickens	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
1930	3,004	$353,377	16,267	$1,078,649	2,462	$36,820	3,514	$34,104	155,943	$179,334
1920	5,004	677,585	17,585	1,466,848	4,206	77,136	3,423	41,275	93,851	[1] 124,874
1910	5,421	648,199	17,229	514,566	4,099	34,363	7,003	33,280	[1] 92,712	[1] 67,696
1900	6,275		23,075		4,251		15,428		77,676	[1] 37,053
1890	5,977		18,609		6,366		13,702		71,145	
1880	6,071		25,595		7,159		10,036		63,391	

[1] All poultry.

TABLE 3.—*Value of agricultural products in Chemung County, N. Y., in 1929*

Crop	Value	Livestock and livestock products	Value
Cereals	$275,102	Domestic animals	$1,510,525
Other grains and seeds	33,324	Dairy products sold	1,098,857
Hay and forage	622,882	Poultry and eggs sold	553,344
Vegetables, including potatoes	356,704	Wool	5,890
Fruits and nuts	58,069	Honey	10,571
All other field crops	55,132	Total	3,179,187
Nursery, greenhouse, and hothouse products	317,754	Total agricultural products	4,898,154
Total	1,718,967		

From the point of view of total acreage, hay, including alfalfa, is the most important crop grown. A total of 31,704 acres was devoted to hay crops in 1929. Timothy and clover sown together accounted

for 24,395 acres, all clovers 2,988 acres, alfalfa 1,279 acres, and small grains cut for hay and annual grasses made up the rest. The average acre yield of timothy and clover was 1.03 tons, clovers sown alone yielded 1.9 tons, and alfalfa 2.3 tons. The alfalfa and clover production is limited to farms located on the valley soils, as the physical properties of the upland soils prevent the successful growing of these crops. A mixture of timothy and clover is grown mainly on the upland soils.

Oats produced an average yield of 23 bushels an acre in 1929. This crop is grown on practically all the farms and is used as a nurse crop for seeding timothy and clover. It is utilized on the farm as feed.

Buckwheat occupies about the same number of acres as oats. This crop is limited largely to the upland section, where it can be produced on the poorer soils. It is an important cash crop in this part of the county. A small quantity is used as chicken feed, and the rest is sold as grain.

A census report of 1840 gives the acreage of corn as 6,461, with a yield of 177,965 bushels. At that time all the corn was grown for grain and was shipped to market over the Susquehanna River. The total corn acreage in 1929 was 5,771, of which corn from 666 acres was harvested for grain, from 1,012 acres was cut for fodder, and from 4,060 acres was cut for silage. The grain production is limited to the valleys where the length of the growing season is somewhat more certain. Corn for silage, although greater yields are obtained on the valley soils, is also grown throughout the upland section. The average yield of silage corn is 9 tons an acre.

Wheat is a comparatively unimportant crop, all of which is used on the farms for feed. The 1840 census report gives the acreage of wheat as 17,807 acres in 1839, but by 1929 it had declined to 1,668 acres.

The potatoes produced in 1929 were grown partly for home use and partly as a cash crop. The average yield was 79 bushels an acre. The town of Southport in the southwest corner of the county accounted for a high percentage of the acreage.

Tobacco is an important cash crop through the Big Flats section. The average yield in 1929 was 1,196 pounds an acre. The acreage devoted to this crop has steadily decreased from 1,988 acres in 1899 to only 279 acres in 1929.

Vegetable production is of local importance in the vicinity of Elmira, where most of the produce is disposed of at roadside markets. In 1929, of the 620 acres devoted to vegetables, asparagus occupied 27, green beans 63, cabbages 88, sweet corn 162, onions 27, and peas 26. There were 557 acres devoted to the production of dry beans, all of which were grown on the soils of the Chemung Valley.

Fruit growing is comparatively unimportant, only 1,337 acres being devoted to orchards in 1929. There were in that year 33,504 producing apple trees yielding 20,125 bushels, 2,218 cherry trees yielding 165 bushels, and 2,470 pear trees yielding 1,233 bushels. Near Elmira, in conjunction with vegetable production, there were 17 acres of blackberries and dewberries yielding 10,382 quarts, 48 acres of raspberries yielding 32,719 quarts, and 54 acres of strawberries yielding 89,512 quarts.

Table 4 gives the acreage and yield of the principal crops, as reported by the census.

TABLE 4.—*Acreage and production of principal crops in Chemung County, N. Y., in stated years*

Crop	1879		1889		1899	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Oats	16, 796	505, 528	18, 060	511, 890	18, 291	517, 590
Wheat	10, 056	118, 034	3, 274	53, 713	5, 161	83, 090
Buckwheat	8, 182	105, 112	11, 604	198, 157	12, 530	153, 230
Corn (grain)	8, 352	265, 446	4, 524	133, 434	7, 816	235, 630
Potatoes	2, 402	198, 775	2, 316	102, 896	2, 993	299, 903
		Tons		*Tons*		*Tons*
Hay	39, 840	42, 369	48, 459	58, 152	45, 994	39, 581
Corn (silage)						
Alfalfa [1]						
		Pounds		*Pounds*		*Pounds*
Tobacco	1, 102	1, 571, 885	941	1, 246, 977	1, 988	2, 903, 700
		Value		*Value*		*Value*
Vegetables					673	$72, 098

Crop	1909		1919		1929	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Oats	15, 371	233, 138	12, 488	223, 989	6, 390	146, 405
Wheat	2, 220	47, 219	2, 370	45, 964	1, 668	31, 331
Buckwheat	12, 087	188, 079	6, 955	107, 199	6, 377	75, 569
Corn (grain)	3, 955	106, 999	2, 019	106, 750	662	29, 136
Potatoes	3, 724	370, 110	2, 641	286, 666	1, 992	156, 506
		Tons		*Tons*		*Tons*
Hay	41, 208	30, 619	45, 765	44, 322	31, 704	35, 400
Corn (silage)					4, 060	36, 926
Alfalfa [1]	83	109	156	287	1, 279	2, 843
		Pounds		*Pounds*		*Pounds*
Tobacco	1, 093	1, 512, 462	606	853, 581	279	335, 577
		Value		*Value*		*Value*
Vegetables	969		461		620	$123, 510

[1] Included in hay.

During 1929, 1,264 tons of commercial fertilizer were purchased by farmers in Chemung County, which amounted to an average of slightly more than 2 tons a farm reporting. Much of this represents superphosphate. Ground limestone also is used extensively, but only a small quantity of complete fertilizer is used, most of it by vegetable growers on the alluvial soils around Elmira. Superphosphate (16-percent acid phosphate) is applied in quantities ranging from 150 to 300 pounds an acre on either corn or oats. Buckwheat usually receives a light application.

The amount expended for labor during 1929 was $278,443, with 769 farms reporting, an average of $362 a farm. The average daily wage for the same year was $2.30. Most of the labor is recruited at Elmira. During 1932 much less was expended for labor than during 1929. Many of the farmers exchange labor during threshing time and when the silos are filled.

In 1930, of a total of 1,565 farms, 523 ranged from 100 to 174 acres in size, 440 from 50 to 99 acres, 220 from 175 to 259 acres, and 172 from 20 to 49 acres. The average size of farms for the same year was 115.1 acres. There has been a steady, though slight, increase in size since 1900, when the average was 96 acres. Most of the smaller farms are in the vicinity of Elmira and are devoted to the produc-

tion of vegetables and flowers. The larger farms are in the towns of Erin and Baldwin in the eastern part of the county.

The approximate land area is 260,480 acres, 69.2 percent of which is in farms. Of the farm land, 47.2 percent is classed as crop land, 31.2 percent pasture land, 15 percent woodland not pastured, and 6.5 percent all other land. All the abandoned land is in the upland section, with the highest percentage occurring in the towns of Erin, Baldwin, and Catlin.

Full owners operated 1,269 farms during 1930, part owners 119, tenants 169, and managers 8. On the 169 tenant farms, 48 were operating on a cash basis and 121 on a share basis. On a share basis, the owner usually furnishes the fertilizer and part of the seed and in return receives one-half of the crop.

The 1930 value of implements per farm amounted to $996. During the same year there were 391 tractors and 397 trucks in operation. Automobiles numbered 1,315.

The average value of all farm property in 1930 was $8,389, land representing 29.5 percent, buildings 45.7 percent, implements 11.9 percent, and domestic animals 12.9 percent.

Dairying is the principal type of farming. The cereals, hay, and forage grown are used principally for feeding dairy cattle. Nearly 50 percent of all land in farms is devoted to hay and pasture and only 13 percent to all other crops. Dairying has developed because there is fast and efficient rail transportation to large consuming centers and because the soils of a large percentage of the county, as a result of their inherent properties, are limited to crops such as hay and small grains or those that can be utilized on the farms as feed for dairy cows.

The production of fluid milk is the most important phase of dairying. During 1929, of the 5,769,817 gallons of milk produced, 4,314,863 gallons were sold as whole milk. The milk is hauled to receiving depots maintained by cooperative organizations and the independent concerns which pasteurize and ship it to cities. Approximately 50 percent of the total supply is consumed locally; the remainder goes to New York City.

Practically all the winter feed, other than hay and silage, is purchased locally in Elmira through cooperative stores. All the oats grown are utilized as feed for horses. Buckwheat is the only cash crop of most of the farms in the hill section. Some of it is used as feed for poultry and the rest is traded locally.

The agriculture of the upland section is not very diversified, being limited to field crops used as feed on the farms. The valley farms, however, because of superior soil conditions, are capable of successfully producing a greater variety of crops, in conjunction with dairying.

Tobacco production is of considerable importance in the vicinity of Big Flats and east of Horseheads. During 1929 it was grown by 59 farmers on 279 acres. The 335,577 pounds produced was disposed of to dealers who buy direct from the farmers. There has been a steady decline in the acreage devoted to tobacco since 1900, and the acreage will probably continue to decrease, on account of the prevailingly low prices received by the growers. The crop demands heavy fertilization and intensive cultivation.

SOILS AND CROPS

The underlying rocks which have contributed most of the materials from which the soils of Chemung County have developed were formed from sediments laid down during the Devonian period, and they comprise alternate beds of shales and sandstones. These rocks are of the Chemung group, with the exception of those underlying a small area in the northern part, where rocks of the Portage group are exposed. The entire area of the county has been glaciated, but the mantle of till in the upland part is rather thin and is composed almost entirely of detritus of the local rocks. The drift filling in the valleys, especially the Chemung Valley and extending northward from Horseheads, is deeper and contains a rather large quantity of foreign materials consisting principally of crystalline and limestone erratics.

The sandstone rocks are fine grained and dense and have contributed the greater part of the material from which the upland soils have formed. The soils developed from this weathered material are characteristically silty and contain many angular sandstone fragments. Where the shales have contributed much to the soil-forming material, the resulting soils are inclined to be heavier in texture and have a poorer physical condition. The shale exposures occur at lower elevations, and most of the soils developed from glacial till high in shale content are on the lower slopes. These shale and sandstone rocks are predominantly acid, consequently the soils which have been derived from them are also acid.

The soils in the valleys have developed from recent alluvium, outwash material, and stratified morainic deposits. These materials show the influence of more active glaciation, in that a rather large proportion of the drift has been brought in from regions far to the north. Most of these foreign materials are composed of crystalline and limestone gravel. Rocks of this kind are especially numerous in the lower depths of the morainic areas and in the outwash from these places.

The recent deposits immediately adjacent to streams show the influence of calcareous materials in the alkaline reaction characteristic of the greater part of these areas.

The soils of Chemung County, because of the character of the surface relief, fall naturally into two broad groups, namely, soils occurring in the upland section and those occurring in the valleys. These groups, in order to more adequately bring out the relationships existing between different soils and between soils and crops, have been subdivided on the basis of drainage, topographic position, and reaction.

The following tabulation gives a complete classification of the soils of this county:

UPLAND OR PLATEAU SOILS

1. Well-drained soils:
   (a) Acid ---- Lordstown
2. Imperfectly drained soils:
   (a) Acid ---- Mardin and Canfield
   (b) Alkaline ---- Langford
3. Poorly drained soils:
   (a) Acid ---- Volusia and Fremont
   (b) Alkaline ---- Erie
4. Permanently wet soils:
   (a) Acid ---- Chippewa

VALLEY SOILS

1. Well-drained soils from ice-laid deposits:
    - (a) Acid .... Wooster
    - (b) Alkaline .... Lansing
2. Well-drained soils from old water-laid deposits:
    - A. Soils on terraces:
        - (a) Acid .... Chenango and Unadilla
        - (b) Alkaline .... Howard and Dunkirk
    - B. Soils from irregular morainic materials:
        - (a) Acid .... Otisville
        - (b) Alkaline .... Groton
3. Well-drained soils from alluvial materials:
    - (a) Acid .... Tioga
    - (b) Alkaline .... Chagrin
4. Imperfectly drained soils:
    - A. Soils on terraces:
        - (a) Alkaline .... Caneadea
    - B. Soils of the first bottoms:
        - (a) Acid .... Middlebury
        - (b) Alkaline .... Eel
5. Poorly drained soils:
    - A. Soils of the first bottoms:
        - (a) Acid .... Holly
        - (b) Alkaline .... Wayland

MISCELLANEOUS LAND TYPES

1. Alluvial soils, undifferentiated.
2. Muck.
3. Rough stony land.

In the following pages, the soils of Chemung County are described in detail, and their agricultural relationships are discussed; their location and distribution are shown on the accompanying soil map; and their acreage and proportionate extent are given in table 5.

TABLE 5.—*Acreage and proportionate extent of the soils mapped in Chemung County, N. Y.*

Type of soil	Acres	Per-cent	Type of soil	Acres	Per-cent
Lordstown stony silt loam	48,256	18.5	Chenango gravelly silt loam, alluvial-fan phase	3,200	1.2
Lordstown stony silt loam, steep phase	29,632	11.4	Chenango gravelly fine sandy loam	2,176	.8
Mardin gravelly silt loam	24,896	9.6	Chenango gravelly loam	1,152	.4
Mardin gravelly silt loam, steep phase	3,264	1.2	Unadilla silt loam	3,200	1.2
Canfield gravelly silt loam	12,928	5.0	Groton gravelly loam	2,304	.9
Canfield gravelly silt loam, steep phase	576	.2	Otisville gravelly loam	1,024	.4
Langford gravelly silt loam	1,664	.6	Chagrin silt loam	1,216	.5
Volusia gravelly silt loam	60,864	23.4	Chagrin silt loam, high-bottom phase	768	.3
Volusia gravelly silt loam, shallow phase	832	.3	Chagrin fine sandy loam	960	.4
Volusia gravelly silt loam, steep phase	1,152	.4	Chagrin fine sandy loam, high-bottom phase	1,728	.7
Fremont gravelly silt loam	6,208	2.4	Tioga fine sandy loam	512	.2
Erie gravelly silt loam	1,344	.5	Tioga fine sandy loam, high-bottom phase	1,216	.5
Chippewa gravelly silty clay loam	2,752	1.1	Tioga silt loam	1,472	.6
Lansing gravelly silt loam	1,664	.6	Tioga silt loam, high-bottom phase	1,280	.5
Lansing gravelly silt loam, steep phase	576	.2	Caneadea silt loam	448	.1
Wooster gravelly silt loam	6,208	2.4	Caneadea silt loam, poorly drained phase	64	.1
Wooster gravelly silt loam, steep phase	64	.1	Eel silt loam	1,152	.4
Howard gravelly loam	7,168	2.7	Middlebury silt loam	3,008	1.1
Howard fine sandy loam	512	.2	Wayland silty clay loam	768	.3
Dunkirk fine sandy loam	3,776	1.4	Holly silty clay loam	1,216	.5
Dunkirk fine sandy loam, steep phase	64	.1	Carlisle muck	320	.1
Dunkirk silt loam	2,048	.8	Alluvial soils, undifferentiated	3,008	1.1
Dunkirk silt loam, steep phase	704	.3	Rough stony land (Lordstown material)	1,792	.7
Chenango gravelly silt loam	9,344	3.6	Total	260,480	------

WELL-DRAINED UPLAND SOILS

The well-drained upland soils include only those of the Lordstown series. They are shallow light-brown silty soils with a considerable quantity of sandstone fragments scattered throughout the soil profile. These soils occur on the plateau summits, higher ridges, hilltops, and steep upper slopes, and they account for a high percentage of the total upland area.

The surface relief may be flat, undulating, or steep. On the steeper slopes, outcrops of the underlying rocks are common. Where the surface relief is favorable and the stone content not too great, the soils of this series are fairly productive, more so than the other upland soils.

Lordstown stony silt loam.—Lordstown stony silt loam has a yellowish-gray or brown friable mellow gravelly silt loam surface soil extending to a depth of about 8 inches. It is underlain, to a depth of 14 inches, by light-yellow or yellowish-gray friable mellow silt loam containing fewer small stone fragments than the surface soil. The subsoil, extending from a depth of 14 inches to bedrock, which in most places is within a depth of 36 inches, is grayish-yellow or drab gritty silt loam. Numerous angular stone fragments, ranging from 1 to 10 inches in diameter, are scattered throughout the subsoil. The soil is noncalcareous throughout.

Some areas of Lordstown stony silt loam, most noticeably in the upland section south of Elmira, contain a sufficiently large quantity of stone on the surface to render them nonagricultural, and in other areas the soil material may be too thin for tillage operations.

The Lordstown soils have been derived partly from a thin mantle of glacial till and partly from materials produced through the weathering in place of the underlying rocks. The till material is composed entirely of decomposition products of the underlying sandstone.

The Lordstown soils are extensively developed in all parts of the county, most of the bodies occurring as circular areas, which include the hilltops, and as long narrow strips on the steeper slopes.

Dairying is the principal type of farming on the farms located on these soils, and, where surface relief is favorable and the soils are not too stony or too thin, good results are obtained with most crops. The moderate texture and friable well-drained character of Lordstown stony silt loam is well suited to the production of potatoes. This crop, however, is of little importance except in the town of Southport in the southwest corner of the county. The principal crops grown are timothy and clover for hay, oats, buckwheat, potatoes, and silage corn. Approximately 35 percent of the Lordstown soils is cropped, 40 percent remains in forest, 10 percent is used as pasture, and 15 percent is idle or abandoned.

Lordstown stony silt loam, steep phase.—The separation of the steep phase of Lordstown stony silt loam is based largely on surface relief, the slopes being so steep as to render the land largely nonagricultural. The soil mantle is inclined to be thin, and there are numerous outcrops of the underlying rocks. With the exception of an occasional pastured area, this soil still remains in forest of second-growth hardwoods, together with some hemlock and white pine.

IMPERFECTLY DRAINED UPLAND SOILS

The imperfectly drained upland soils, which include soils of three series—the Mardin, Canfield, and Langford—are widely distributed through the uplands in all parts of the county. They are developed in areas having moderate or steeply sloping surface relief. These soils have developed from glacial till composed largely of decomposition products of the local underlying rocks. Generally speaking, they have gray surface soils underlain by mottled compact subsoils. The compaction is distinct enough to cause the soils to be classed locally as "hardpan soils." Surface drainage is good in most places, but the compact subsoil impedes internal movement of water. Many sandstone fragments occur throughout the soil. The Mardin and Canfield soils are acid in reaction, and the Langford soil has an acid surface soil and an alkaline subsoil. The Mardin soils represent an intermediate stage of development between the Lordstown soils and the Fremont soils. They have developed from glacial till deposits derived from the same source, that is, the dense fine-grained sandstone rock underlying the region. The differences among these three soils lie mainly in their drainage characteristics. They are also associated with the Volusia soils.

Mardin gravelly silt loam.—The 8-inch surface soil of Mardin gravelly silt loam is yellowish-gray or olive-gray gritty silt loam which is, in most places, gravelly or stony. The gravel consist of angular fragments of sandstone. The subsurface soil, to a depth of about 16 inches, is smooth yellowish-brown firm silt loam. The upper subsoil layer, which extends to a depth of 24 inches, is moderately compact drab or gray, slightly mottled with yellow and brown, gritty silt loam. From this depth to a depth of 36 inches, the material grades into dense tight heavy silt loam highly mottled with yellow, gray, and rust brown. The lower subsoil layer is dense, hard, compact gray or greenish-gray silty clay loam. The mottling fades out at a depth of about 36 or 40 inches.

In most places many sandstone fragments, ranging in size from gravel to stones 10 inches in diameter, are scattered through the soil. The soil is noncalcareous throughout.

The surface relief of this soil is smooth, gently sloping, or moderately steep. The soil occurs in all the upland sections of the county, but it is most extensively developed throughout the eastern half.

The imperfect internal drainage and compact subsoil reduce the agricultural value of this land below that of the better areas of Lordstown stony silt loam. Dairying is the principal type of farming in the section where this soil is most extensively developed. The most important crops grown are timothy and clover for hay, oats, buckwheat, and silage corn. A small acreage is devoted to potatoes, but the soil is not well adapted to this crop.

Approximately 30 percent of the Mardin soils is cropped, 25 percent used as pasture, 15 percent abandoned, and the rest still remains in forest composed of second-growth hardwoods.

Mardin gravelly silt loam, steep phase.—Those areas of Mardin gravelly silt loam, where the slope is so steep as to render them difficult of cultivation and to materially reduce their agricultural value, have been separated as a steep phase. Aside from a somewhat

thinner surface soil and possibly a greater quantity of stones on the surface, the soil characteristics are essentially the same as those of the typical soil. A very small proportion of the steeper land is under cultivation. Of the areas utilized, pasture accounts for the greatest acreage. A few of the more favorably situated fields are in hay. By far the greater part of this land still remains in forest of second- and third-growth hardwoods.

Canfield gravelly silt loam.—The Canfield soils are intermediate in development between soils of the Wooster and Volusia series. They are not so well drained as the former and are better drained than the latter. The subsurface soil and surface soil are somewhat similar to the corresponding layers of the Wooster soils, and the subsoil resembles the Volusia subsoil, both in compactness and degree of mottling.

The Canfield soils have developed from deep deposits of glacial till derived largely from the local underlying shale and sandstone rocks, with a slight mixture of foreign crystalline materials. Like the Lordstown, Volusia, and Wooster soils, they are noncalcareous throughout.

The distinction between these soils and the Mardin soils is sometimes arbitrary, as are the boundaries between them where the two soils occur contiguously. In general, however, the Canfield soils have been derived from deeper till deposits, they contain a greater quantity of foreign materials, the subsoil is more compact and hard, and the textures of the soil layers are heavier, even though both are classed as silt loams. Also the Canfield soils, where typically developed, occur at a lower elevation on the slopes.

The surface soil of Canfield gravelly silt loam is composed of yellowish-brown or light-yellow mellow silt loam containing a variable quantity of angular sandstone fragments. The upper subsoil layer, to a depth of about 12 inches, is yellowish-brown smooth silt loam underlain to a depth of 24 inches by highly mottled slightly compact smooth silt loam. The mottling is rust brown and gray. The lower subsoil layer, extending beyond a depth of 40 inches, is hard compact slightly mottled silty clay loam. The mottling fades out at a depth of about 40 inches. Throughout the soil are angular sandstone fragments, ranging from 1 to 8 inches in diameter and occurring in different quantities.

The surface relief ranges from rolling to gently or steeply sloping. These soils occur in all parts of the upland section of the county, but the largest and most typically developed areas are in the vicinity of Breesport. The total extent of the Canfield soils is less than that of the Lordstown, Volusia, or Mardin soils.

The agricultural value of this soil may be classed as medium. It is greater than that of the Volusia soils, less than that of the Lordstown soils, and similar to that of the Mardin soils.

Canfield gravelly silt loam is a hay, pasture, and small-grain soil. The crops, in order of their importance, are timothy and clover, oats, buckwheat, and silage corn. Moderate yields of these crops are obtained. The imperfect drainage and hard compact subsoil limit the use of the land to the crops named.

Approximately 50 percent of the Canfield soils is cropped, 20 percent is used as pasture, 15 percent is idle or abandoned, and the rest is in forest and wood lots.

Canfield gravelly silt loam, steep phase.—Similarly to the separation of steep phases in other soils, the steep phase of Canfield gravelly silt loam is based on surface relief rather than soil condition. The agricultural value of the steeper land is rather low. The more favorably situated areas may be in hay or used as pasture. The larger part of the land, however, still remains forested.

Langford gravelly silt loam.—Langford gravelly silt loam is very similar to Canfield gravelly silt loam in all physical characteristics of the upper part of the soil profile, the only distinction, and the one on which the separation is based, being the alkaline reaction of the subsoil in the Langford soil. This alkalinity, or calcareousness, has been inherited from the parent material which, in the Langford soil, is composed of glacial till derived largely from products of the local underlying shale and sandstone rocks.

Topographic position and surface relief are also similar to those of Canfield gravelly silt loam. The Langford soils are less widely developed and consequently of less importance than the Canfield.

The surface soil of Langford gravelly silt loam is composed of gray, yellowish-gray, or olive-gray friable gravelly silt loam. It is underlain to a depth of 12 inches by slightly compact grayish-yellow or pale-yellow somewhat gravelly silt loam. The upper part of the subsoil, between depths of 12 and 24 inches, is drab or gray highly mottled heavy silt loam which is dense, compact, and hard. The mottlings in this layer are steel gray, yellow, and rust brown. The lower subsoil layer is drab or greenish-gray compact and hard heavy silt loam or silty clay loam. Many angular sandstone fragments, ranging from 1 to 6 inches in diameter, are scattered throughout the soil profile.

Langford gravelly silt loam is utilized largely in the production of such field crops as timothy and clover, oats, buckwheat, and silage corn. The imperfect drainage and hard, compact character of the subsoil limit its use to such crops. The cropping characteristics are similar to those of the Canfield and Mardin soils. However, yields are somewhat higher on the Langford soil under the same system of management.

The soil is limited in extent and is mapped only in the vicinity of Sullivanville.

POORLY DRAINED UPLAND SOILS

The poorly drained upland soils are represented by the Volusia, Erie, and Fremont series. Soils of the Volusia series occur in all the upland parts of the county. Some of the larger continuous areas are in the northeastern part. The Fremont soils are not so widely developed as the Volusia. They occur on level or gently sloping areas on the plateau top. The Volusia soils are typically developed at the lower elevations where they receive considerable seepage water. The Volusia and Fremont soils have developed from deposits of glacial till composed, for the most part, of local materials. They have gray surface soils underlain by highly mottled compact subsoils, the compaction being much more distinct in the Volusia soils. The Erie soil differs from the Volusia soils only in the alkaline reaction in its subsoil. The Fremont and Volusia soils are strongly acid in reaction.

Volusia gravelly silt loam.—The 6- to 8-inch surface soil of

Volusia gravelly silt loam is composed of gray (very light gray when dry) moderately mellow heavy silt loam or silty clay loam. In cultivated fields the surface soil in most places has a cloddy structure. If the soil is not worked when moisture conditions are optimum it tends to puddle badly. The subsurface layer, to a depth of 13 inches, is yellowish-gray or pale-yellow firm heavy silt loam, in some places slightly mottled. The upper subsoil layer, between depths of 13 and 25 inches, is tight and compact silty clay loam highly mottled with rust brown, yellow, and gray. The lower subsoil layer is composed of drab or greenish-gray extremely hard and compact silty clay loam. In common with the other upland soils, this soil has variable quantities of angular sandstone fragments over the surface and throughout the soil.

The compaction in the Volusia soils is much greater than in the other upland soils. It stops the downward movement of water, and only a very few roots are able to penetrate into or through this indurated or hardpan layer. These soils are wet, are cold in the spring, and they remain water-logged until all the excess water is lost by evaporation, after which they tend to bake and crack and assume a poor physical structure or tilth.

These soils have developed from a mantle of glacial till derived from a mixture of the local underlying shale and sandstone rocks and are noncalcareous throughout. No other single soil in the county has so wide a distribution or occupies such large areas as Volusia gravelly silt loam. It occurs on gentle or moderately steep slopes or in areas having a rolling or undulating surface relief, generally in close association with the Lordstown soils. Where the latter soils occupy the highest elevations, the Volusia soils are everywhere developed on the lower slopes where they receive seepage water from higher lying areas. It is not uncommon to see a distinct break in the surface relief where the Volusia soils begin.

The poor drainage and hard compact subsoil characteristics of the Volusia soils contribute to low productivity. The soils are best adapted to timothy, buckwheat, and oats. Clover is not a success, because of the excessive heaving of the ground that commonly occurs. Buckwheat, requiring only a short growing season, can be planted after the soil dries out in the spring. Oats and silage corn do moderately well in the more favorably situated areas. These are the most important crops produced on the Volusia soils. It is apparent from the crops grown that the income of a farm located on Volusia gravelly silt loam would be obtained largely from the sale of dairy products.

The percentage of abandonment is greater on land of this kind than on any other. Approximately 45 percent of the land is under cultivation, 20 percent is used as pasture, 20 percent is abandoned, and the rest is in forest of second- and third-growth hardwoods.

Volusia gravelly silt loam, shallow phase.—Certain areas of soils with characteristics similar to Volusia gravelly silt loam, but with the underlying rocks approaching within 36 inches or less of the surface, have been designated as a shallow phase. These areas have even poorer drainage than the typical gravelly silt loam. The soil is very limited in extent and is agriculturally unimportant.

Volusia gravelly silt loam, steep phase.—The areas of Volusia soil that are so steep as to materially reduce the value of the land for

agriculture have been separated as a steep phase. This soil is of limited extent. The cleared areas are either used as pasture or are abandoned. A high percentage of the land still remains in forest.

Fremont gravelly silt loam.—Fremont gravelly silt loam is a poorly drained upland soil occurring in close association with the Lordstown and Volusia soils. It is everywhere developed at a higher elevation than the Volusia soils and may occur between those soils and the Lordstown soils. It occupies flat areas or swales on the plateau top. Besides the difference in topographic position, it differs from Volusia gravelly silt loam in that it has a lighter textured surface soil and is not so hard or compact in the subsoil layers.

The 6- to 8-inch surface soil of Fremont gravelly silt loam is composed of gray friable smooth silt loam containing only a moderate quantity of small sandstone fragments. The subsurface material is yellowish-brown or pale-yellow smooth mellow silt loam underlain to a depth ranging from 20 to 24 inches by moderately dense and compact heavy silt loam which is slightly mottled with brown, gray, and yellow. The lower subsoil layer, to a depth of about 36 inches, is drab or greenish-gray mottled compact and hard heavy silt loam. The substratum, or material below a depth of 36 inches, is similar to the material in the layer immediately above, except that the mottled effect fades out at a depth of about 3 feet. The proportion of rock fragments may be greater at the lower depths.

This soil, like the Lordstown, has formed partly from a thin mantle of glacial till derived entirely from local rocks and partly from materials produced by the weathering in place of the underlying rock. It is, however, considerably deeper than the Lordstown soil. The Fremont soil is strongly acid throughout.

The agricultural value of Fremont gravelly silt loam is not high. Like all the upland soils, with the possible exception of the Lordstown, the original fertility was low, and not much has been done to increase the productiveness. The soil is best adapted to timothy, buckwheat, and oats. Clover can be grown with fair success if the soil is limed. Much of the land has been abandoned and is growing up to brush and weeds.

The largest areas occur throughout the town of Catlin in the western part of the county, but the total acreage is not great.

Erie gravelly silt loam.—Erie gravelly silt loam bears the same relationship to Volusia gravelly silt loam that the Langford soil bears to the Canfield. The surface soils of the Erie and Langford soils are not so acid as are the surface soils of the other two soils, and the subsoils are alkaline or calcareous, whereas the Volusia and Canfield soils have acid, noncalcareous subsoils.

The Erie soil occupies similar topographic positions and has the same character of surface relief as Volusia gravelly silt loam, and there is no apparent difference in physical characteristics of the two profiles.

This soil is adapted only to such crops as timothy, buckwheat, oats, and corn. Yields may be somewhat higher than on the Volusia soil because of the more alkaline character of the soil material. This is a minor soil in Chemung County because of its low agricultural value and limited extent.

PERMANENTLY WET UPLAND SOILS

The permanently wet upland soils are represented by only one soil—Chippewa gravelly silty clay loam, which is developed in swales and depressions in association with other upland soils. It has a dark surface soil, high in organic matter, and a compact highly mottled subsoil. This soil occurs only in small widely scattered areas. The aggregate acreage is small, and the soil is unimportant agriculturally.

Chippewa gravelly silty clay loam.—The surface soil of Chippewa gravelly silty clay loam consists of gray or dark-gray heavy silt loam or silty clay loam, high in organic matter. The upper subsoil layer is drab, gray, or greenish-gray, mottled with yellow, brown, and gray, compact silt loam. The lower subsoil layer is compact and hard, and it may contain numerous sandstone fragments. The material is noncalcareous.

This soil represents a wet, depressional, or swale, condition in the upland section, and both surface and internal drainage are poor. In some places, the water may stand over the surface during much of the year. The soil occurs in close association with the Lordstown and Volusia soils. It occupies small scattered areas throughout the upland part of the county, and the aggregate acreage is small. In places where the timber has been removed, the only use that can be made of this land is pasture.

WELL-DRAINED VALLEY SOILS FROM ICE-LAID DEPOSITS

The well-drained valley soils from ice-laid deposits are represented by soils of two series—the Wooster and the Lansing. These soils have developed from a deep mantle of glacial till deposited at the base of, and on, the lower slopes. They are brown or light brown, moderately compact in the subsoils, and contain many small angular fragments of sandstone. The Wooster soils are acid throughout, and the Lansing soils have alkaline subsoils. The soils of these two series are not extensively developed. The Wooster soils occur in small areas over the entire county, but the Lansing soils are limited to the section north of Horseheads and thence to the county line.

Lansing gravelly silt loam.—The surface soil of Lansing gravelly silt loam is composed of gray, dark-gray, or brownish-gray friable mellow gritty silt loam. In cultivated areas, the surface soil is, in most places, of the lighter colors, and the darker shades occur where the soil is in sod or in a virgin condition. The subsurface soil, between depths of 6 and 14 inches, is yellowish-gray faintly mottled friable gritty silt loam which is somewhat crumbly and granular. The upper subsoil layer, between depths of 14 and 26 inches, is similar to the layer above, except that the material is moderately compact and hard, rather than friable. A slight mottling of brown and gray may also be present. The subsoil, from a depth of 26 inches downward, is composed of brown or reddish-brown heavy gritty silt loam or silty clay loam, which is compact and dense in places. The material increases in hardness and compaction with depth.

There may be a rather large quantity of angular sandstone fragments scattered over the surface and throughout the soil. The surface and subsurface layers are acid, but the subsoil is alkaline in reaction.

The Lansing soils occupy gently sloping or steep areas having smooth surface relief. They have developed from a mantle of glacial till derived from a mixture of local and foreign materials. In places, they have the appearance of having been reworked with a considerable amount of the pink or red lacustrine material which occurs adjacent to the Lansing soils.

Lansing gravelly silt loam is probably the most productive soil in the county, exclusive of those occurring at lower elevations. Its importance in the agriculture is limited only by its small acreage. Clover, timothy, corn, oats, and potatoes are the most important crops grown.

The Lansing soils occur only in a comparatively narrow strip extending along the east side of the valley from Pine Valley north to the county line.

Lansing gravelly silt loam, steep phase.—The separation of the steep phase of Lansing gravelly silt loam is a distinction based mainly on topographic position rather than any soil characteristic. There may be places on the steeper slopes where the underlying rocks come close to the surface or protrude above. In general, the steep phase has a greater number of stone fragments scattered over the surface than the typical soil. The agricultural value of this steep land is rather low, and the soil is largely used as pasture land, although the more favorably situated areas produce fair crops of hay, corn, and oats.

Wooster gravelly silt loam.—The 6- to 10-inch surface soil of Wooster gravelly silt loam consists of yellowish-brown or yellowish-gray friable loose silt loam containing a noticeable quantity of small sandstone fragments. The upper subsoil layer, to a depth of 2 feet, is yellowish-gray gravelly silt loam, only slightly more firm and compact than the surface soil. The lower subsoil layer is drab or greenish-gray moderately compact gravelly loam. This soil is noncalcareous throughout. A few areas, in which the quantity of surface stones is excessive, are indicated by stone symbols. The Wooster soils have developed from deep deposits of glacial till derived from both local and foreign materials. The larger part of the soil material, and in some places the entire amount, has been contributed by the local shale and sandstone rocks. Where other material is present it consists of crystalline rocks.

The soil mapped as Wooster gravelly silt loam in the vicinity of Chemung differs from the typical soil in that a considerable quantity of water-worn gravel may be present and in that the subsurface material is very silty. The glacial till, from which the soil in these areas has developed, has been reworked with a large quantity of alluvial material.

The characteristic features of the Wooster soils are the well-oxidized surface soils and friable, well-drained subsoils. These soils are usually developed at the base and on the lower slopes of the plateau, immediately above the valley floor. The surface relief is smooth or moderately undulating.

Wooster gravelly silt loam does not occur in extensively developed areas but in small scattered bodies in all parts of the county. It is well adapted to field crops. Excellent yields of corn, hay, oats, and potatoes are obtained. The physical properties of this soil are especially favorable to potatoes. Alfalfa will thrive where the land

is limed. The areas shown on the map with stone symbols are inferior in productivity and are utilized largely as pasture.

Wooster gravelly silt loam, steep phase.—The steep phase of Wooster gravelly silt loam, aside from having a shallower surface soil, is not materially different in profile characteristics from the typical soil. The distinction between the two is based entirely on topographic position. The agricultural value of the steep land is low, as the land cannot be tilled with any degree of success. It is very inextensive.

WELL-DRAINED VALLEY SOILS FROM OLD WATER-LAID DEPOSITS

Well-drained valley soils from old water-laid deposits, occurring as terraces, may, on the basis of the geological processes by which the materials were accumulated, be further subdivided as follows: Those developed from deposits accumulated as outwash material or as deltas, those developed from materials laid down in glacial lakes, and those occurring on morainic deposits, as kames. In the first division are the Chenango, Unadilla, and Howard soils; in the second, the Dunkirk; and in the third, the Groton and Otisville. All the soils of this group, except the Groton and Otisville, occupy level or gently rolling terrace positions, and, with the exception of the Chenango, Otisville, and Unadilla soils, all have calcareous or alkaline subsoils. The Howard, Chenango, and Unadilla soils are characterized by brown gravelly surface soils underlain by stratified deposits of gravel and sand or sand and silt. The Dunkirk soils, having developed from materials deposited in still water, lack the gravel characterizing the other soils of the group. They are heavier textured and are inclined to show a pinkness in color of all soil layers, except the surface soil. Well-drained valley soils derived from material occuring on morainic deposits, as kames, are characterized by a rolling, hummocky, irregular surface relief. These are light-brown soils containing considerable gravel in the surface layers, and they are underlain at comparatively slight depths by stratified deposits of sand and gravel. As a whole, the soils of this subgroup are not widely distributed. They everywhere occur on the lower slopes immediately above the valley floor.

The soils of this group are developed in all parts of the county, but the larger and more typically developed areas extend from Big Flats eastward to Horseheads. The typical Dunkirk areas are in the valley north of Horseheads, extending to the county line. This group includes some of the most important and most productive soils in the county.

Howard gravelly loam.—Howard gravelly loam has a surface soil averaging 6 inches in thickness, that is composed of grayish-brown friable loose gravelly loam. Under cultivation the surface soil has a dustlike single-grain structure, but where it is in sod distinct granulation is apparent. The upper subsoil layer consists of yellowish-brown or light-yellow gritty silt loam containing less gravel than the surface soil. This layer is moderately dense and firm but not compact. It breaks into small irregular cubes which are easily crushed. This layer, characteristic of all members of the Howard series, ranges in thickness from 10 to 24 inches. Between depths of 24 and 36 inches is a layer of reddish-brown gravelly silt loam.

During the development of the soil there has been considerable infiltration of fine material into this horizon, which has tended to bind the gravel together and is responsible for the slight plasticity characteristic of the layer. The substratum, or the material below a depth of 36 inches, is composed of sand and gravel, in most places showing distinct stratification.

The gravel of the Howard soils is composed of smooth water-worn round and subangular fragments of the local shale and sandstone rocks, together with much crystalline material brought in from the north. At a depth of 3 feet, limestone gravel is reached, and from this depth downward it comprises from 10 to 50 percent of the total. All calcareous materials have been leached from the surface soil which is moderately acid. An alkaline reaction is apparent at a depth of about 2 feet, and free lime is reached at a depth ranging from 3 to 4 feet.

The Howard soils occupy level or gently undulating terrace positions. With the exception of one or two small areas, they are limited to the section around Horseheads and south from that place to Elmira. Some variations in texture of the surface soil may occur but are not great enough to warrant separation as another soil type. One or two small bodies west of Horseheads approach gravelly silt loam, and an area south of Pine Valley has a more rolling surface than is typical.

The soils of this series are among the most productive in the county. They are especially well adapted to alfalfa, as the light texture of the surface soil and the loose, porous, well-drained subsoils with their alkaline reaction are ideally suited to this and allied crops. Tobacco is grown to some extent and with good results, but soils containing less surface gravel seem to be preferred for this crop. The most important crops produced on the Howard soils with their average acre yields are as follows: Silage corn 10 tons, alfalfa 3 tons. timothy and clover 2 tons, tobacco 1,200 pounds, and oats between 35 and 40 bushels.

Probably 90 percent of the total acreage of the Howard soils is under cultivation, and 10 percent is in pasture.

Howard fine sandy loam.—Howard fine sandy loam has a 6- to 8-inch surface soil composed of brownish-gray or light-brown loose friable fine sandy loam which, in some places, contains considerable fine gravel and grit. The upper and lower subsoil layers are like those of the gravelly loam.

This soil is inextensively developed, and it occurs only in the section north of Horseheads. No tobacco is produced, but alfalfa, timothy and clover, silage corn, and oats are grown with results comparable to those obtained on the gravelly loam.

Dunkirk fine sandy loam.—The 8-inch surface soil of Dunkirk fine sandy loam is composed of brownish-gray slightly granular mellow fine sandy loam that may contain a small quantity of rounded gravel. The upper subsoil layer, to a depth of about 14 inches, is yellowish-brown firm light silt loam. The lower subsoil layer is dense and compact reddish-brown clay containing many nodules or streaks of lime.

In places the lower subsoil layer may be composed of stratified layers of sand, or there may be gravel beds below a depth of 4 feet.

Such conditions as these are not typical, however, and are present only where the soil occurs on the west side of the valley north of Horseheads.

The Dunkirk soils occupy high bench or terrace positions with moderately rolling surface relief. The sediments from which the soils have developed were laid down in still water as lake terraces. Subsequent erosion has given them their present rolling and eroded surface relief.

Dunkirk fine sandy loam, as mapped west of Horseheads, differs somewhat from that north of the same village, in that it has a yellowish-brown rather than a reddish-brown cast, and the subsoil shows less stratification and carries more sand and less silt than the material described above. The soil material has the appearance of shallow-water deposits.

Dunkirk fine sandy loam and Dunkirk silt loam have slightly acid surface soils and calcareous subsoils. They rank high as agricultural soils and are adapted to a wide range of crops. Dairying is the principal industry of farms located on them. The most important crops grown are timothy, clover, alfalfa, oats, and corn, with some tobacco produced in the vicinity of Big Flats.

Dunkirk fine sandy loam, steep phase.—The steep phase of Dunkirk fine sandy loam represents steep hillsides and highly eroded areas that are not suited to cultivation. There is no difference between the typical soil and the steep phase in profile characteristics. The steeper land has a low agricultural value and is utilized mostly as pasture.

Dunkirk silt loam.—The surface soil of Dunkirk silt loam consists of a 4- to 8-inch layer of grayish-brown or yellowish-brown friable and granular smooth silt loam. The subsurface material is light-gray or yellowish-gray firm silt. The gray subsurface layer is more highly developed on the level or flat areas. In areas where the surface relief is rolling, the gray layer is absent or only faintly apparent.

The subsoil consists of grayish-brown or reddish-brown silts and clays, somewhat marbled in appearance. On drying, deep vertical cracks appear in the subsoil layers.

The silt loam, like the fine sandy loam, may show considerable stratification in the lower depths and in places may be underlain by gravel deposits.

The cropping system on the silt loam is similar to that on the fine sandy loam, and yields are about the same. The silt loam, however, cannot be worked under such a wide range of moisture conditions, as it puddles badly if worked when wet.

Dunkirk silt loam, steep phase.—The steep phase of Dunkirk silt loam represents steep eroded hillsides of Dunkirk silt loam, that are not suited for cropping. Erosion takes place at a rapid rate on these unprotected slopes which are characterized by many deep ravines. The land is used exclusively for pasture.

Chenango gravelly silt loam.—The 6-inch surface soil of Chenango gravelly silt loam is gray (when dry) gravelly silt loam or loam, showing slight granulation. The upper subsoil layer, which extends to a depth ranging from 18 to 24 inches, is pale-yellow or grayish-yellow gritty silt loam. It is more compact and contains

much less gravel than the surface soil. Between depths of 24 and 36 inches, the material is reddish-brown loose unassorted sand and gravel. The substratum is composed of loose porous gray sand and gravel, which are either unassorted or stratified.

The gravel of this soil, and of the Chenango soils in general, is composed largely of rounded fragments of the local shale and sandstone rocks, with variable quantities of crystalline materials brought in from the north. The gravel in both the surface soil and subsoil are acid. Limestone gravel may occur at a depth of 5 feet but nowhere above this depth. The only difference between the Chenango and Howard soils is in the depth at which limestone gravel is present. In the Chenango soils it does not occur in the upper 5 feet, whereas in the Howard soils it is present between depths of 2 and 3 feet.

The Chenango soils are developed in level or gently sloping terrace positions in all parts of the county, but the largest and most typical areas are throughout the Chemung Valley.

These soils are among the most productive in the county. Approximately 75 percent of them is cropped, 15 percent is used as pasture land, and 10 percent is idle, either because of an excessive content of gravel or the size and shape of the area. They are devoted largely to field crops, in conjunction with dairying. Alfalfa and clover grow well. Liming is necessary to start these legumes, however, since the soils have an acid reaction. The most important crops grown, with their approximate acre yields are as follows: Timothy and clover 2 tons, silage corn 10 tons, alfalfa 2½ tons, oats 38 bushels, and potatoes 125 bushels.

Chenango gravelly silt loam, alluvial-fan phase.—The alluvial-fan phase of Chenango gravelly silt loam includes the soil developed from material deposited by tributary streams at points where they emerge from the hills and join the main valleys. All the materials are local in character, and the gravel is of a more angular type than that characteristic of the Chenango soils occurring along Chemung River. In places there are sufficient angular shale and sandstone fragments to give the soil a stony character.

The agricultural value of the alluvial-fan phase is lower than that of the typical gravelly silt loam. The land is harder to work because of the greater quantity of gravel present, and in some places it is excessively drained, resulting in a droughty condition. Soil of this phase is widely distributed, but most of the individual bodies are small, the only exception of importance being the area just north of Big Flats which is more than 100 acres in extent.

The land is utilized largely in the production of such crops as alfalfa, timothy and clover, silage corn, and oats.

Chenango gravelly fine sandy loam.—Chenango gravelly fine sandy loam is the same in all essential characteristics as Chenango gravelly silt loam, except that the surface soil contains a higher proportion of sand in relation to the silt and clay. This soil is adapted to similar crops and is utilized in the same way as the gravelly silt loam. It is developed most extensively in the southeastern part of the county along Chemung River. The area mapped as gravelly fine sandy loam south of the river and adjoining the Pennsylvania State line is lighter in texture than the average of this soil and contains a larger quantity of surface gravel, enough in this particular area to reduce the agricultural value of the land.

Like all members of the Chenango series this soil is acid in reaction, and it requires the use of lime for the successful production of alfalfa and clover.

Chenango gravelly loam.—Chenango gravelly loam has a 6- to 8-inch grayish-brown surface soil containing a large quantity of angular and subangular sandstone and shale fragments scattered over the surface and throughout the soil. The upper subsoil layer is pale-yellow gravelly loam which is slightly firm in place but is nevertheless open and porous. The lower subsoil layer is composed mostly of shale and sandstone fragments, with little finer material. In places there may be a small amount of crystalline material. The gravelly loam is somewhat similar to the alluvial-fan phase of the gravelly silt loam, especially in the character of the gravel. The former soil, however, occurs in larger areas and has a more level surface relief.

In agricultural value Chenango gravelly loam ranks between the gravelly silt loam and the alluvial-fan phase. It is utilized for general field crops, such as timothy and clover, corn, oats, and alfalfa.

Unadilla silt loam.—The surface soil of Unadilla silt loam is grayish-brown friable loose silt loam which, in a few places, has a few gravel scattered over the surface. The subsurface soil, between depths of 8 and 14 inches, is composed of yellowish-brown or grayish-yellow firm very fine sandy loam or silt loam, underlain to a depth of 26 inches by brownish-yellow or pale-yellow moderately compact very fine sand or silt. The lower subsoil layer, to a depth of about 50 inches, is dense and compact reddish-brown gritty silt loam. Below a depth of 50 inches shale and sandstone gravel, together with a small quantity of limestone, may be present.

There is considerable variation in the texture of the material making up this soil. Some areas may be composed largely of silt, and others may contain a rather large quantity of sand. Both conditions occur in the vicinity of Big Flats. A very silty area is just east of this village, and one containing considerable sand borders the village on the south. The soil in these places is largely free from surface gravel, but in the southeastern part of the county much gravel is scattered over the surface.

Unadilla silt loam occupies a topographic position similar to that of the Chenango soils and, like the latter, is acid in reaction. It is distinguished from the Chenango soils by the almost total absence of surface gravel. It is an excellent agricultural soil but is not extensive. Some tobacco is grown in the vicinity of Big Flats. Most of the land, however, is utilized in the production of hay, oats, and corn.

Groton gravelly loam.—Groton gravelly loam has been derived from materials deposited by the action of water, as evidenced by the assorted and stratified character of the substratum. The Groton soils are everywhere characterized by their rough, hummocky, irregular surface relief.

The surface soil, extending to a depth of 6 or 8 inches, is gray or grayish-brown loose and mellow gravelly loam. The quantity of surface gravel varies, but it is in few places sufficient to seriously interfere with cultivation. The subsurface material, between depths of 8 and 20 inches, is yellowish-gray gravelly silt loam. It is distinctly

heavier in texture but only slightly more firm or compact than the surface soil. Underneath this and extending to a depth ranging from 30 to 36 inches, there is, in most places, a mixture of reddish-brown gravel and sand, together with a small quantity of silty material. Many of the gravel are covered with a thin coating of silt. The substratum, occurring below a depth of 36 inches, is composed of beds of sand and gravel, which nearly everywhere have a stratified or layered arrangement.

The surface soil and upper part of the subsurface soil are acid, but the subsoil is alkaline at a depth of 3 feet or less.

The gravel in the surface soil and subsurface soil are largely rounded shale and sandstone fragments, with a small quantity of crystalline material. Limestone gravel appears at a depth ranging from 24 to 36 inches, and from this depth downward it accounts for a large percentage of the total material.

Groton gravelly loam occurs in comparatively small bodies in all sections of the county. All areas of this soil are developed at the junction of the valley floor and the lower slopes.

Because of the light texture and open porous character of the subsoil, drainage in many places is excessive, and crops suffer from lack of moisture during dry periods. This feature, together with rough surface relief, reduces the agricultural value of the land to a comparatively low state. Certain areas, however, may have a somewhat deeper and heavier textured surface soil. Such places, if the surface relief is not too uneven, are ideally adapted to alfalfa production. Other field crops can also be produced with good results on the deeper areas.

In general, the limited extent and unfavorable surface relief of this soil give it little significance among the agricultural soils of the county.

Otisville gravelly loam.—The statement made about Groton gravelly loam, in regard to its derivation, occurrence, and surface relief, applies also to Otisville gravelly loam.

The 6-inch surface soil of Otisville gravelly loam consists of gray loose and open gravelly loam. It is underlain to a depth of 16 inches by light-yellow or yellowish-gray gravelly silt loam which is slightly compact in place. Between depths of 16 and 36 inches, the material is a mixture of gravel and sand, together with a small amount of silt. The lower subsoil layer, or substratum, may be unassorted gravel and sand or stratified beds of the same material. There may be considerable hardness or compaction between depths of 16 and 48 inches, caused in part by an infiltration of fine material which has acted as a binding agent.

The gravel contained in this soil has been derived almost entirely from the local shale and sandstone rocks. There is very little crystalline material and no limestone to a depth of about 10 feet. As a result of its derivation from shale and sandstone gravel, the soil is acid to fairly great depths. The character of the materials and the reaction have been the bases for separating this soil from Groton gravelly loam.

The physical characteristics of the soil, such as its droughtiness and rough surface relief, contribute to a low agricultural value. On the heavier textured areas, where surface relief is more favorable,

alfalfa and clover can be grown with fair success if the land is limed. Aside from the few acres devoted to field crops, the land is used for pasture or is lying idle.

WELL-DRAINED ALLUVIAL SOILS

These well-drained soils have developed from recently deposited alluvium immediately adjacent to the streams. The soils of this group have brown or dark-brown surface soils, are moderately high in organic matter, and are underlain by material slightly heavier in texture and lighter in color. Stratified deposits of gravel and sand may be present at different depths. The soils of this group occur along all the streams, but the most extensive and better developed areas are throughout the Chemung Valley. The well-drained soils on the first bottoms are represented by soils of two series—the alkaline Chagrin soils and the acid Tioga. They are the most productive soils in the county.

Chagrin silt loam.—Chagrin silt loam has an 8-inch surface soil composed of yellowish-brown or grayish-brown friable mellow silt loam showing considerable granulation. The upper subsoil layer, to a depth of 24 inches, is yellowish-brown firm but not compact silt loam. The lower subsoil layer differs little from the material described, except that it is more compact and shows greater variation in texture. Beds of sand and gravel may be present at the lower depths.

The Chagrin soils are well supplied with organic matter. One area in particular, located south of Big Flats, is especially high in this constituent and has given rise to a much darker surface soil than is typical of the soils of this series.

The Chagrin soils are developed from recent alluvial deposits in the form of low terraces and first bottoms along stream courses. The lower areas may be subject to overflow during periods of excessively high water, which, however, does not occur frequently enough to greatly reduce the agricultural value of the land.

The most extensive areas occur along Chemung River and Newtown Creek. Some spots, which have a moderate quantity of gravel scattered over the surface, are shown on the map by gravel symbols.

The Chagrin soils have developed from fine materials washed from the surrounding uplands and from calcareous sediments brought in from the north. All the lime, however, has been leached from the surface soil. The subsoils are everywhere alkaline at a depth of 3 feet.

These are probably the most productive soils in the county. Their physical condition is good, and they can be worked under a wide range of moisture conditions. Textures are sufficiently heavy to hold enough moisture for the production of all the common crops. They are especially well adapted to the production of vegetables, and in the vicinity of Elmira a rather large quantity of vegetables and small fruits is produced on these soils. The Chagrin soils are utilized to the greatest extent, however, in the production of field crops. A small acreage south of Big Flats is devoted to tobacco.

The most important crops with their approximate acre yields are as follows: Timothy and clover 2½ tons, silage corn 12 tons, oats 45 bushels, alfalfa 3 tons, and tobacco 1,400 pounds. Approximately

65 percent of the Chagrin soils is cropped, and 35 percent is used as pasture.

Chagrin silt loam, high-bottom phase.—The high-bottom phase of Chagrin silt loam occupies a former first-bottom position, but, owing to the streams cutting deeper channels, these areas have been isolated as a low terrace. Land of the high-bottom phase is not subject to overflow. It occurs in close association with the soils of the first bottoms.

Crop adaptations and yields are the same on the high-bottom phase as on the typical soil.

Chagrin fine sandy loam.—Chagrin fine sandy loam is the same in all essential characteristics as Chagrin silt loam, except that the surface soil contains a higher percentage of sand. The fine sandy loam is utilized for the same crops and yields are as great as on the silt loam.

Chagrin fine sandy loam, high-bottom phase.—The high-bottom phase of Chagrin fine sandy loam bears the same relation to the fine sandy loam as the high-bottom phase of Chagrin silt loam bears to the silt loam, the only distinction being a difference in topographic position. Land utilization and crop yields are similar on the two soils.

Tioga fine sandy loam.—The surface soil of Tioga fine sandy loam is yellowish brown when dry and grayish brown when moist. The texture is predominantly fine sandy loam, though in some bodies it approaches sandy loam. The material in this layer is loose, friable, and moderately granular. The upper subsoil layer, between depths of 8 and 24 inches, is yellowish-gray slightly compact fine sandy loam, The lower subsoil layer is yellowish-brown fine sandy loam which is more compact than the material above. The subsurface layers of this soil, and of the Tioga soils in general, are variable, in that thin zones of coarse sand or silt may be present or there may be rather large quantities of gravel scattered throughout the profile. It is not uncommon to find beds of gravel and sand underlying the Tioga soils. All members of the Tioga series are acid in reaction, both in the surface soil and subsoil.

Tioga fine sandy loam and other members of the Tioga series are most extensively developed along Chemung River in first-bottom and low-terrace positions. The first-bottom areas are subject to overflow at infrequent intervals. The Tioga soils have developed from sediments washed from the surrounding hills and brought in from the north, and these are derived mainly from acid sandstone and shale.

The soils of this series have a high degree of productivity, being equal to the Chagrin soils in this respect. They are important soils, notwithstanding their rather limited extent. With the exception of small areas in the vicinity of Elmira, devoted to the production of vegetables and small fruits, and the few acres devoted to tobacco, they are utilized in the production of field crops in conjunction with dairying. Liming is necessary for such legumes as alfalfa and clover. The important crops with their approximate acre yields are as follows: Timothy and clover 2 tons, silage corn 12 tons, alfalfa 2½ tons, oats 45 bushels, and tobacco 1,400 pounds. Approximately 75 percent of the total area of these soils is cropped, and 25 percent is used as pasture.

Tioga fine sandy loam, high-bottom phase.—The high-bottom phase of Tioga fine sandy loam occupies a slightly higher topographic position than the typical fine sandy loam. The typical soil may be subjected to infrequent overflows, but the high-bottom phase lies above the flood plain and is seldom, if ever, flooded. Aside from this factor, the two soils are similar in all essential characteristics. Land utilization and crop yields are much the same.

Tioga silt loam.—Tioga silt loam differs from other members of the Tioga series only in texture of the surface layer. As the name indicates, the silt loam contains more fine material, as silt and clay, and less sand than the fine sandy loam. Like the fine sandy loam, it may be expected to vary somewhat in surface texture. Some areas might classify as very fine sandy loam and others as heavy silt loam. In occurrence, position, crop adaptations, and yields, it is similar to the fine sandy loam.

Tioga silt loam, high-bottom phase.—This soil bears the same relation to the silt loam as the high-bottom phase of the fine sandy loam bears to the fine sandy loam. Aside from having a slightly higher topographic position, it is similar to the low-bottom type, both in manner of utilization and crop yields.

IMPERFECTLY DRAINED VALLEY SOILS

The imperfectly drained valley soils include the Caneadea soils, which occupy a terrace position, and the soils of the Eel and Middlebury series, developed on first bottoms and low terraces. The Caneadea soils have developed from materials laid down in still water, and, where typically developed, they are gravel free, are gray, and have mottled subsoils. The soils of this series are inextensively developed and have little significance in the agriculture of the county. The Eel and Middlebury soils are developed from recent alluvial materials and occur in association with the better drained Tioga and Chagrin soils. Unlike the Chagrin soils they are mottled in the subsoil as a result of their imperfect drainage. Aside from this feature, they are the same as the soils of the well-drained first bottoms. The Middlebury soil is acid in reaction and the Eel is alkaline.

Caneadea silt loam.—The Caneadea soils have been derived from sediments laid down in glacial lakes. They occupy terraces, the surface relief of which may be level, rolling, or rough, depending on the extent to which erosion has taken place.

The surface soil of Caneadea silt loam may be brown, grayish-brown, or gray, depending on the quantity of organic matter present. The texture ranges from silt loam to silty clay loam. In the heavier textured areas the surface soil tends to puddle and clod under cultivation. The subsurface soil, between depths of 7 and 15 inches, is yellow or yellow-brown heavy silt loam mottled with rust brown, yellow, and gray. When dry, this layer has a distinct platy structure. The lower subsoil layer, to a depth of 36 inches, is composed of drab or greenish-gray silty clay loam, dense and tight in place, which, on drying, opens into large vertical cracks. The substratum, or material below a depth of 36 inches, is heavy drab clay which is tight and dense in place.

The surface and subsurface layers are acid in reaction, but the subsoil is alkaline and carries free lime at a depth of about 48 inches.

There may be stratified beds of silts, clays, and sands underlying the Caneadea soils. The area just west of Breesport is underlain by such beds and in addition contains considerable gravel at a comparatively great depth. The presence of gravel in the lower layers is not typical of the Caneadea soils.

Caneadea silt loam, because of its physical characteristics, is best adapted to small grains, corn, and timothy and clover. This soil, owing to its very limited extent, is unimportant agriculturally.

Caneadea silt loam, poorly drained phase.—Although the Caneadea soils as a whole have been classified as imperfectly drained, there are a few areas in which internal drainage is not so effective as in the typically developed soil. The poorer drainage is reflected in a more intensive mottling and the grayer color of the subsurface layers.

The poorly drained phase of Caneadea silt loam has a grayish-brown gritty silt loam somewhat gravelly surface soil underlain to a depth of 12 or 14 inches by grayish-yellow mellow silt loam. The subsoil is drab or gray heavy gritty silt loam, highly mottled with rust brown and gray. The material is hard, compact, and largely impervious to movement of water.

This soil occurs in only a few comparatively small bodies lying between Big Flats and Horseheads. It has a moderately level or rolling surface relief and lies somewhat higher than the surrounding country, which gives the bodies a rounded knoll effect.

All this poorly drained land is under cultivation to crops, such as corn, oats, and timothy and clover. It is not a good alfalfa soil because of the hard compact poorly drained subsoil. Clover is sometimes subject to heaving if not protected by a blanket of snow during the winter.

Eel silt loam.—The Eel soils have been derived from recent alluvial sediments, and they differ from the Chagrin soils only in their imperfect internal drainage.

The surface soil of Eel silt loam consists of a 6- to 8-inch layer of grayish-brown or brown mellow silt loam or silty clay loam, rather high in organic-matter content. It is underlain, to a depth ranging from 18 to 24 inches, by yellowish-brown firm heavy silt loam. The subsoil, betwen depths of 24 and 36 inches, is yellowish-brown moderately dense and tight heavy silt loam or silty clay loam, mottled with rust brown, yellow, and gray. Below a depth of 36 inches, the material may range in texture from silty clay loam to fine sand, and it is distinctly mottled with gray, yellow, and brown.

Although the surface soil and subsurface soil are slightly acid, the subsoil becomes alkaline at a depth ranging from 24 to 36 inches, and in this respect it closely resembles the Chagrin soils. The Eel soils do not occur in large bodies but as narrow strips or slightly depressed areas, generally along the smaller streams.

This soil is unimportant agriculturally, because of its very limited extent. It is largely utilized as hay and pasture land. However, corn and oats can be grown with moderate success on the larger and better drained areas.

Middlebury silt loam.—Middlebury silt loam is an imperfectly drained soil derived from recent alluvial sediments. This soil, which is acid throughout, is differentiated from Eel silt loam on the basis of reaction. Aside from this factor, the two soils are similar.

The 6- to 8-inch surface soil of Middlebury silt loam is composed of gray or yellowish-brown silt loam free from gravel and slightly granular. The subsurface material, to a depth of 15 inches, has similar textural properties but is faintly mottled with rust brown and yellow. It is firm but not compact. The subsoil, to a depth of 30 inches, is dense smooth silt loam highly mottled with yellow, gray, and brown. It grades, at a depth of 40 inches, into heavier and more compact material which is less distinctly mottled. Layers of gravel and sand may be present below a depth of 40 inches, but such a condition is not typical.

The Middlebury soil has developed from sediments washed from the surrounding uplands and derived largely from shale and sandstone rocks. It occurs in small bodies along the minor streams in most parts of the county. The largest and most extensively developed areas are along Cayuta Creek in the vicinity of Van Etten.

Because of imperfect drainage, the land is best adapted to hay and pasture. Oats and corn can be grown with fair results on the more favorably situated areas. This is not an important soil agriculturally, because of its rather limited extent.

POORLY DRAINED VALLEY SOILS

The poorly drained valley soils include the Wayland and Holly soils, both of which occupy first-bottom positions and are too wet to have much value for agriculture, except as pasture land. Their derivation is much the same as that of other soils of the first bottoms. The Wayland soil is alkaline, and the Holly is acid.

Wayland silty clay loam.—The surface soil of Wayland silty clay loam is composed of dark-gray or olive-gray silty clay loam high in organic matter, which, under sod, is in many places highly granular. Under cultivation the material puddles and forms hard clods. The subsurface soil, between depths of 5 and 13 inches, is dense tough dark-gray clay loam mottled with rust brown. It grades into material of lighter texture and a more highly mottled appearance. The texture of the lower subsoil layer, extending from a depth of 30 inches downward, may range from fine sand to clay. The material in this layer is only slightly mottled and is not so dense or plastic as that in the layers above.

Considerable variation occurs in areas of the Wayland soil, both in color and texture of the subsoil layers. The characteristic features of this soil are the wet highly mottled condition and the alkaline reaction of the subsoil.

The Wayland soil occupies first-bottom positions and is generally developed in small areas in association with the Chagrin and Eel soils. Its physical characteristics and poor drainage limit its use to pasture and some hay. It is very inextensive and is agriculturally unimportant.

Holly silty clay loam.—The surface soil of Holly silty clay loam consists of gray or dark-gray silty clay loam which is rather high in organic matter. The subsurface material, between depths of 6 and 14 inches, is firm dense silty clay loam highly mottled with gray, yellow, and rust brown. The subsoil is highly mottled heavy plastic clay. Below a depth of 30 inches, blue-gray highly plastic clay is commonly present. This soil is noncalcareous throughout.

Holly silty clay loam is developed in first-bottom positions and has a level or depressed surface relief. Both surface and internal drainage are poor, water in many places covering the surface in the depressions for the greater part of the year.

This soil has been derived from recent alluvial sediments, and it occurs in close association with the Chagrin, Eel, Wayland, and Middlebury soils. It differs from the Wayland soil only in reaction, as it is acid throughout. It is largely nonagricultural, although the better drained areas may furnish some pasture. The total area is small.

MISCELLANEOUS LAND TYPES

The miscellaneous land types include those classed as Carlisle muck, alluvial soils, undifferentiated, and rough stony land. Carlisle muck represents the organic deposits of the county, the only areas of note lying between the villages of Horseheads and Pine Valley. Alluvial soils, undifferentiated, represent a soil condition not readily classified and include excessively wet areas suitable for neither cropping nor pasture. Rough stony land, as the name implies, includes land which is too stony and steep to be of any agricultural value.

Carlisle muck.—The topmost 15 or 20 inches of Carlisle muck consists of black incoherent decomposed vegetable matter containing different quantities of silt and clay washed in from the surrounding areas of mineral soil. The substance below a depth of 20 inches is somewhat browner and is more fibrous. Beds of bluish-gray clay or marl underlie this material, occurring, in places, within 3 feet of the surface. The average thickness of the muck, however, is greater than 36 inches, and in some places the thickness may exceed 10 feet. The surface layer of the muck is, in general, acid, but an alkaline reaction is characteristic of the lower lying material.

Only one important area of muck is mapped in Chemung County, north of the village of Horseheads, and part of it is sufficiently well drained to allow cultivation. Vegetables, such as celery, lettuce, and onions, are the principal crops grown. One or two small areas occur farther north, but they require drainage before they can be brought under cultivation.

Alluvial soils, undifferentiated.—Included in the classification—alluvial soils, undifferentiated—are abandoned stream channels, gravel wash from streams (both of which are subject to periodic flooding), and very wet and swampy areas, in which the soils are derived from miscellaneous materials. Most of the wet and swampy areas occupy first-bottom or terrace positions and are associated with the Holly, Wayland, and Eel soils. These areas are largely nonagricultural. The better areas, however, may furnish a small amount of pasturage. The aggregate acreage of these undifferentiated soils is small.

Rough stony land (Lordstown material).—Rough stony land represents a topographic rather than a soil condition, and it includes steep, precipitous areas which are entirely nonagricultural and in places are too steep to support a forest cover. The soil, in places where the slope has allowed it to remain, has been derived from materials similar to those producing the Lordstown soils. Rough stony land occurs along Chemung River west of Elmira and near Chemung.

AGRICULTURAL METHODS AND MANAGEMENT

With dairying the dominant type of farming in Chemung County, the crops having the greatest acreage would necessarily be those used as feed or forage. The common rotation followed by practically all the farmers is corn, oats, and hay, the hay consisting of timothy and clover mixed. On most of the dairy farms, located throughout the valleys, a 4-year rotation is commonly practiced. The timothy and clover are seeded with the oats and are plowed under at the end of the fourth year. In the upland section the common practice is to allow the meadows to stand an additional 2 years, making a 6-year rotation.

Where alfalfa is substituted for timothy and clover, the rotation is lengthened until the alfalfa meadow runs out. The acreage devoted to alfalfa, however, is rather low, and this crop may be grown independently of the regular rotation. It is grown only in the valleys, because the physical properties of upland soils will not allow its growth.

Very little complete fertilizer is used. Superphosphate, however, is commonly applied at a rate ranging from 150 to 300 pounds an acre on either corn or oat land. The farmyard manure is commonly applied to the corn land, at a rate ranging from 8 to 10 loads an acre. Part of the manure may be spread on the meadows.

Lime is applied on new meadows, most frequently in the form of ground limestone. The rate of application ranges from 500 to 2,000 pounds an acre. A greater quantity is used on alfalfa than on clover.

Buckwheat is the only cash crop of the upland section and it is grown independently of the regular rotation. Because of the short growing season necessary to mature this crop, it can be planted after the regular spring work is completed. It receives little fertilization. Superphosphate, at the rate of 150 or 200 pounds an acre, may be applied occasionally.

Plowing is done in the fall when the weather allows. The ground freezes in November and seldom thaws sufficiently for working before April. Much of the soil in the upland section dries out slowly. The compact subsoil prevents downward movement of moisture; consequently surplus water is lost through run-off and evaporation.

The only specialized crop of Chemung County is tobacco, and this is limited largely to the country between Big Flats and Horseheads. This crop is not grown in a special rotation but on many farms succeeds itself year after year in the same fields. The only fertilization it receives is large quantities of manure. The crop requires and receives intensive cultivation. The tobacco plants are started from seed in hotbeds and are transplanted to the field between May 15 and June 1. They are set by horse-drawn planters. The crop is weeded and cultivated intensively, and harvesting takes place during the latter part of August or the first week in September. The plants are cut and hauled to large barns or sheds, where they are allowed to cure for several months before the crop is sold.

Vegetable growing, practiced in the vicinity of Elmira, represents an intensive type of agriculture. The 620 acres devoted to the various vegetables in 1929, with the exception of the muck area north

of Horseheads, represent first-bottom or high-bottom phases of the Chagrin, Tioga, and Wheeling soils. These are composed of deep gravel-free material which is ideally adapted to extensive cultivation. Not only vegetables, but small fruits and flowers, are grown on these soils. The soils are plowed in the spring and, because of their well-drained character, can be worked under a rather wide range of moisture conditions. Much fertilizer is used, largely of a 5-10-5 analysis.[1]

Potatoes are not an important crop. Less than 2,000 acres are devoted annually to this crop. Most of the potatoes are produced in the town of Southport on the Lordstown soils.

SOILS AND THEIR INTERPRETATION

Chemung County lies entirely within the Appalachian Plateau region of New York, which is the northern extension of the uplands along the western base of the Appalachian Mountains. It lies within the region of gray-brown forest soils of northeastern United States, characterized as such because of the prevailing light color of the surface soils which, having developed under a cover of mixed deciduous trees, are naturally low in organic matter.

The soils have developed under the podzolization process, resulting in a loss of the mineral constituents of the surface soil, with a redeposition of the iron and alumina in the B horizon. None of the soils, however, has a highly podzolized profile.

The average annual precipitation of nearly 35 inches has been sufficient to cause a continual downward movement of water through the soil profile, with the result that all carbonates have been leached from the A and B horizons of these soils, where conditions have been favorable for normal development to take place.

In the section on Soils and Crops (p. 12), the soils of the county are broadly grouped on the basis of topographic position into valley and upland soils. They are further grouped on the basis of drainage and reaction. The well-drained soils include the Lordstown soils in the upland section and the Howard, Chenango, Dunkirk, Unadilla, Groton, Otisville, Chagrin, and Tioga soils of the lowlands. These soils, among which are those showing the best development, have brown surface soils underlain by noncompact yellowish-brown subsoils.

All the soils are predominately low in organic matter. They have developed under a mixed forest cover, where, if any considerable amount of leaching has taken place, little organic matter will accumulate. The more poorly drained areas, both in the upland section and throughout the valleys, have favored the accumulation of a greater quantity of organic material.

The native vegetation was largely mixed deciduous forest, together with some white pine and hemlock. The predominant species on the thin, high ridges consisted of chestnut, pitch pine, red oak, and scarlet oak. On the lower areas and gentle slopes, where drainage was poorer, white pine made up extensive forests. Throughout the valleys, elm, sycamore, white ash, red maple, and hickory were

[1] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

common. The undergrowth of the hardwood forest consists largely of bunchberry, arrowwood, dogwood, laurel, and wintergreen. Witch-hazel and scrub oak come in rapidly on burned-over areas or where the forest is sufficiently cleared to let in light. Hawthorn is common in pastures, also sweetfern in the higher areas of thin, poor soils.

The entire county was originally covered with a mantle of glacial drift which was thick in the valleys and thin on the ridges and hilltops. Since the soils are comparatively young, they are still rather strongly influenced by characteristics of the glacial material.

The glacial till covering the upland section of the county has been derived almost entirely from the local underlying rocks which are interbedded noncalcareous shales and fine-grained dense sandstones, laid down during the Devonian period. The Lordstown, Fremont, and Mardin soils have been strongly influenced by sandstone, as the glacial till from which they have developed was largely derived from this kind of rock. These soils are characterized by very silty textures, and they have numerous fragments of the underlying rocks scattered over the surface and throughout the soil profile. The Volusia, Erie, Canfield, and Langford soils show a greater assortment of materials in the till from which they have developed. Not only is the influence of the shales more apparent, but crystalline erratics from regions a considerable distance north of this county are present.

The drift filling in the valleys, largely of a water-assorted character, has been derived both from local sandstone and shales and from igneous and calcareous foreign materials. These materials have been deposited in the form of stream and glacial-lake terraces, outwash plains, morainic deposits, and recent alluvium. The valley soils, where the materials are largely local, are acid in reaction, whereas the soils derived from mixed materials have alkaline or calcareous subsoils. In the former group are the Chenango, Tioga, Middlebury, and Holly soils, and in the latter are the Howard, Dunkirk, Chagrin, Eel, and Wayland soils.

The most extensive group is that classed as the poorly drained soils, which includes the Volusia, Erie, Fremont, and Chippewa soils, all, except the Volusia, being of limited extent. These soils are not so well developed as the better drained soils, and they have hard compact subsoils. The two factors of poor drainage and hard compact subsoil layers have played a large part in retarding the normal development of all the upland soils, except the Lordstown.

The mature or normally developed soil of the region has a light-brown or brownish-yellow surface soil, with a yellowish-brown subsurface layer which is heavier in texture than the surface soil. The subsoil is noncompact and friable. The most mature soils in Chemung County, and those showing the best development, are the Lordstown soils in the upland and the Howard, Chenango, and Dunkirk throughout the valleys. Even in these soils, development of a distinct profile is not complete. The age of the soils is not great, consequently the geological characteristics of the parent material are still apparent in the profiles of the various soils.

The Lordstown soils occupy the higher elevations and steeper slopes. They are light brown or yellowish brown and are under-

lain by yellowish-brown slightly heavier material. Numerous thin angular sandstone fragments are scattered over the surface and in places throughout the soil. These are thin soils, bedrock appearing above a depth of 36 inches. The shallowness, good drainage, high oxidation, as evidenced by the color, gravelly or stony character, and strong acidity, characterize the soils of this series.

Following is a description of an undisturbed profile, 1½ miles west of Wells, under cover of second-growth hardwoods: The brown surface material is composed of slightly decomposed litter consisting largely of pine and oak leaves. Immediately below this is a faintly developed gray leached layer not more than a quarter of an inch thick. This layer is present only in spots. From 1½ to 8 inches, the material is brownish-yellow or light-brown gritty silt loam which is friable, loose, and contains a large number of small roots. Underlying this, and continuing to a depth ranging from 16 to 20 inches, is yellowish-gray or light-yellow material which has a gritty silt loam texture and is only slightly firmer than the material in the layer above. From a depth of 20 inches to bedrock the soil is yellowish-gray firm silt loam showing no apparent structure. On the surface there may be a variable amount of stone fragments ranging from 1 to 10 inches in diameter. In places these rock fragments are present throughout the soil.

Related to the Lordstown, but showing less efficient drainage and a mottled compact subsoil, are the Mardin soils which have developed from glacial till derived from the same materials. Soils of both these series are noncalcareous. The Fremont soils differ from the Mardin in having a harder and more compact subsoil, with the mottling closer to the surface. The Fremont is also less well drained than the Mardin.

The Volusia soils are characterized by gray surface soils underlain by very hard compact subsoils representing the closest approach to a true hardpan of any soil in the county. This layer stops the downward movement of water, and roots are unable to penetrate it.

Valley till soils, represented by two members, the Wooster and Lansing, are included with the upland soils. The Wooster soil, however, where typically developed, occurs at the base of, and on, lower slopes. It is a well-drained soil having a brown surface soil and a loose friable subsoil. It has been derived from deep deposits of glacial till composed of a mixture of local shale and sandstone, together with foreign crystalline materials. It is noncalcareous throughout and occurs in association with the Canfield soils. The Lansing soil is not quite so well drained as the Wooster, and it has a more compact subsoil. It has a pink cast and gives the effect of having been reworked with a considerable amount of lacustrine materials from adjacent areas. It has an alkaline subsoil.

The soils described represent the more extensively developed members of all the soils occurring in the upland part of the county. The normal soils of the valley, as expressed by the Howard soils, have brown gravelly surface soils underlain by light-yellow heavier textured subsurface soils and a substratum composed of mixed, or stratified beds of, gravel and sand. A profile of Howard gravelly loam, 3½ miles west of Horseheads, appears as follows: A 6-inch surface soil composed of brown or grayish-brown friable gravelly loam un-

derlain to a depth of 23 inches by yellowish-brown or light-yellow smooth silt loam which is firm but not compact. There is considerably less gravel in the surface soil. From 23 to 36 inches is a reddish-brown horizon consisting of gritty and gravelly silt loam or loam which is somewhat tough and plastic when moist. The substratum, from 36 inches downward, is composed of alternate beds of gravel and sand. The gravel in the first 3 feet of the soil profile is composed largely of water-worn fragments of shale and sandstone, together with a small quantity of crystalline material. From 36 inches downward limestone appears, and at a depth of 4 feet it accounts for from 20 to 50 percent of the total. The surface and subsurface layers are acid in reaction, but the subsoil is alkaline.

In addition to the soils discussed, the Dunkirk soils are well drained, and they represent soils derived from lacustrine sediments. They are characterized by brown or grayish-brown surface soils underlain by stratified beds of sands, silts, or clays, which are largely gravel free. Related to the Dunkirk soils but differing in degree of drainage, are members of the Caneadea series, which have been derived from lake-laid sediments coming mainly from local materials. They have mottled, more compact subsoils. The members of both series have calcareous subsoils.

CLASSIFICATION OF LAND ACCORDING TO NATURAL PRODUCTIVITY

Table 6 gives a classification of the land, according to its natural productivity, for each of the important crops grown in Chemung County.

TABLE 6.—*Classification of land in Chemung County, N. Y., according to its*

Soil type	Productivity rating [1]	Crop-productivity index						
		Silage corn	Oats	Buck-wheat	Timo-thy	Red clover	Alfalfa	Potatoes
	Grade no.	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Chagrin silt loam, high-bottom phase; Chagrin fine sandy loam, high-bottom phase; Tioga fine sandy loam, high-bottom phase; Tioga silt loam, high-bottom phase	1	90	80	50	90	80	50	50
Unadilla silt loam	2	60 (80)	50 (70)	60	80	60 (80)	60 (80)	60 (80)
Dunkirk fine sandy loam	2	40 (60)	50 (70)	60	60	60 (80)	70 (80)	50 (70)
Dunkirk silt loam	3	60 (80)	60 (80)	80	90	70 (80)	40 (60)	40 (60)
Howard gravelly loam; Howard fine sandy loam	3	50 (70)	50 (70)	40	40	50 (60)	60 (80)	60 (80)
Chenango gravelly silt loam; Chenango gravelly fine sandy loam	3	50 (70)	40 (60)	40	30	40 (60)	40 (70)	50 (80)
Chenango gravelly loam; Chenango gravelly silt loam, alluvial-fan phase	4	40 (60)	30 (40)	30	30	30 (50)	40 (60)	40 (60)
Wooster gravelly silt loam	4	60 (80)	60 (80)	70	50	40 (60)	30 (60)	50 (70)
Lansing gravelly silt loam	4	60 (80)	60 (80)	80	70	50 (70)	40 (70)	40 (60)
Chagrin silt loam; Chagrin fine sandy loam; Tioga silt loam; Tioga fine sandy loam	1 [5]	90	80	50	90	80	50	50
	3 [6]	70	50	50	80	60	20	20
Middlebury silt loam; Eel silt loam	2, drained [7]	80	80	70	90	60	10	30
	5, undrained [8]	40	50	30	60	40	-	10

[1] Land having the highest general productivity in the agricultural region in which it occurs is rated grade 1 for that region.
the upper figure refers to the grade number when the land is drained, or protected from flood, and the lower figure refers to the g
tected from flood.

[2] Land most productive for the crop specified=100 percent. Figures in parentheses indicate the productivity of land on wh
ments, as lime, fertilizer, and manure.

[3] Vegetables requiring highly organic soils.

[4] Vegetables not requiring highly organic soils.

[5] Land not subject to overflow. (Protected by dikes, etc.)

[6] Land subject to intermittent flooding.

[7] Land not subject to overflow and artificially drained.

[8] Land subject to overflow and not drained.

TABLE 6.—*Classification of land in Chemung County, N. Y., according to its natura*

Soil type	Productivity rating [1]	Crop-productivity inde						
		Silage corn	Oats	Buck-wheat	Timo-thy	Red clover	Alfalfa	Potatoes
	Grade no.	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Wayland silty clay loam	2, drained	70	70	80	90	60	10	10
Groton gravelly loam	6 [9]	20 (40)	20 (40)	20	30	20 (40)	30 (60)	30 (50)
Otisville gravelly loam	6 [9]	20 (40)	20 (40)	20	30	20 (40)	30 (50)	20 (40)
Lordstown stony silt loam	6	30 (50)	40 (60)	40	40	30	20 (40)	50 (70)
Langford gravelly silt loam								
Canfield gravelly silt loam	5	30 (60)	50 (70)	70	50	40 (60)	20 (30)	30 (50)
Mardin gravelly silt loam								
Caneadea silt loam	4, drained	50 (80)	50 (70)	70	80	50 (70)	30 (40)	30 (40)
Caneadea silt loam, poorly drained phase	5, undrained	40 (70)	40 (60)	70	80	40 (60)	10 (20)	10 (30)
Erie gravelly silt loam	5, drained	30 (60)	40 (60)	60	50	30 (50)		30 (50)
	6, undrained	20 (30)	30 (50)	60	50	20 (30)		10 (20)
Fremont gravelly silt loam	5, drained	30 (60)	40 (60)	60	50	30 (50)		30 (50)
	6, undrained	20 (30)	30 (50)	60	50	20 (30)		10 (20)
Volusia gravelly silt loam	6, drained	30 (60)	30 (50)	50	40	30 (40)		30 (40)
Volusia gravelly silt loam, shallow phase	7, undrained	20 (30)	20 (40)	40	40	20 (30)		10 (20)
Lansing gravelly silt loam, steep phase								
Wooster gravelly silt loam, steep phase								
Mardin gravelly silt loam, steep phase	8	10	10	10	10	10		10
Canfield gravelly silt loam, steep phase								
Volusia gravelly silt loam, steep phase								
Dunkirk fine sandy loam, steep phase	8	10	10	10	20	20	20	
Dunkirk silt loam, steep phase								
Holly silty clay loam	8, undrained	10	10	30	50			
Chippewa gravelly silty clay loam	9, undrained				10			
Alluvial soils, undifferentiated	9, undrained				20	10		
Carlisle muck	5, drained							10 (70)
	9, undrained							
Lordstown stony silt loam, steep phase	10 [10]							
Rough stony land	10 [10]							

[9] Moderately hilly land not well adapted to farm machinery.
[10] Land entirely unfit for agriculture because of steepness.

This classification compares the productivity of each of the different kinds of land in the county for a given crop, to a standard, namely, the most productive land in the United States for that crop. The rating of productivity of a given kind of land for a given crop is called its productivity index for that crop. The most productive land in the United States for a given crop is given a productivity index of 100 percent for that crop, which is called the base index and is the standard with which the productivity of all other land for that crop is compared. Therefore, land estimated to be about half as productive for that crop as the best in the United States receives an index of 50 percent. In addition to productivity indexes for each important crop, each kind of land is assigned a general productivity rating or grading of agricultural quality. The kind of land having the highest average productivity indexes in each of the great agricultural regions is given the rating or grade of 1 for that region, the kind having the next highest the grade of 2, and so on.

In the determination of this general productivity grade, more weight is given to productivity of the important staple crops than of minor crops.

Obviously, the natural productive capacity of land means the productivity without the repeated use of amendments. Yields obtained through the use of amendments do not indicate well the natural productivity of the land. However, some kinds of land, although low in inherent productivity, are responsive to the application of amendments and produce good yields or high quality of product. Because the index of inherent or natural productivity does not express the responsiveness of land to fertilizer, a second index is used (in parentheses) to compare the productive capacity of a given kind of land under the amendment practices most commonly used in the section where it occurs with the productive capacity of the naturally most productive land under the common amendment practices of its section. It compares what may be expected in the way of yield and quality of product from different kinds of land under cultural practices. Quality of product average being equal, it would be approximately the same as a comparison of average yield of product. This index is used only where amendments are added to the land as a common practice. The factors influencing the productivity of land are mainly those of climate, soil, and surface configuration. All are considered in the determination of the productivity indexes, and a low index for a particular crop may as likely be due to an unfavorable climate or surface configuration as to fertility of soil. Surface configuration is important mainly on account of its influence on the amount of water which penetrates the soil and on erosion. It is of course also a secondary factor that helps to determine the character of both climate and soil. Climatic and soil conditions that are a result of surface configuration are considered as climatic and soil factors.

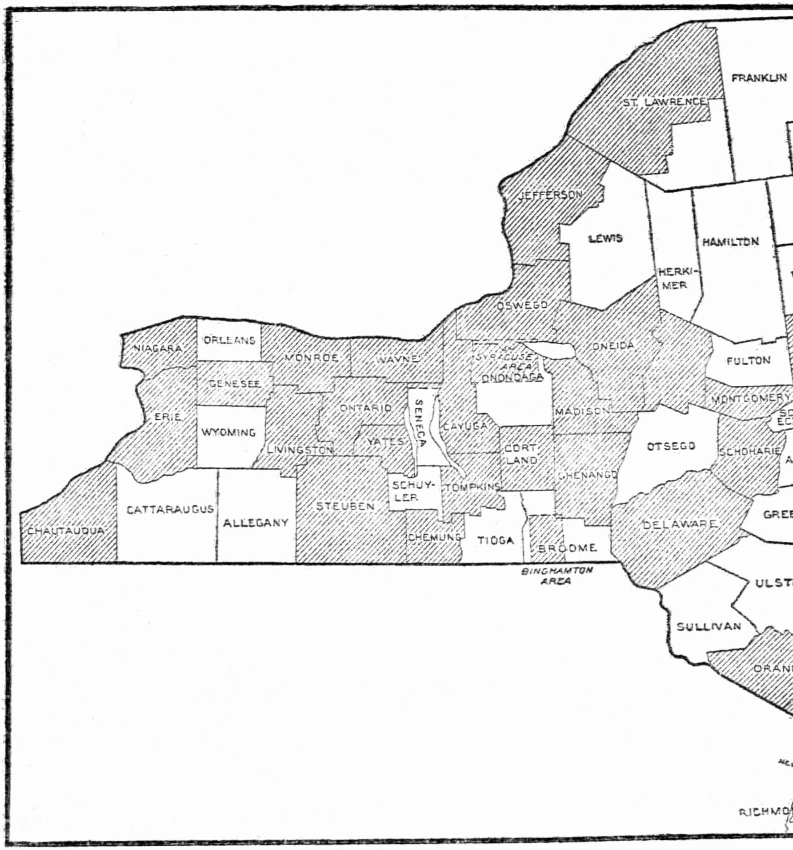
In the case of land with poor natural drainage, two series of indexes are given, one applying to land with no artificial drainage, the other to land to which optimum artificial drainage has been applied. In many instances some artificial drainage, but not the optimum, has been applied to poorly drained lands so that their inherent productivity under optimum drainage is not realized.

In the case of bottom land subject to periodic overflow, two sets of indexes are given, one applying to the land when it receives optimum protection from overflow, the other to the land with no such protection. This double series of indexes is used to indicate the inherent or potential productivity of poorly drained or overflow lands.

The cost or difficulty of effecting drainage or protection from overflow plays no part in the natural productivity rating of such lands. Two kinds of land having the same productivity when drained are rated the same, although optimum artificial drainage may cost 10 times as much on one as on the other.

Authority for printing soil survey reports in this form is carried in the Appropriation Act for the Department of Agriculture for the fiscal year ending June 30, 1933 (47 U. S. Stat., p. 612), as follows:

There shall be printed, as soon as the manuscript can be prepared with the necessary maps and illustrations to accompany it, a report on each soil area surveyed by the Bureau of Chemistry and Soils, Department of Agriculture, in the form of advance sheets bound in paper covers, of which not more than two hundred and fifty copies shall be for the use of each Senator from the State and not more than one thousand copies for the use of each Representative for the congressional district or districts in which a survey is made, the actual number to be determined on inquiry by the Secretary of Agriculture made to the aforesaid Senators and Representatives, and as many copies for the use of the Department of Agriculture as in the judgment of the Secretary of Agriculture are deemed necessary.



Areas surveyed in New York, shown by shading. Detailed surveys shown by

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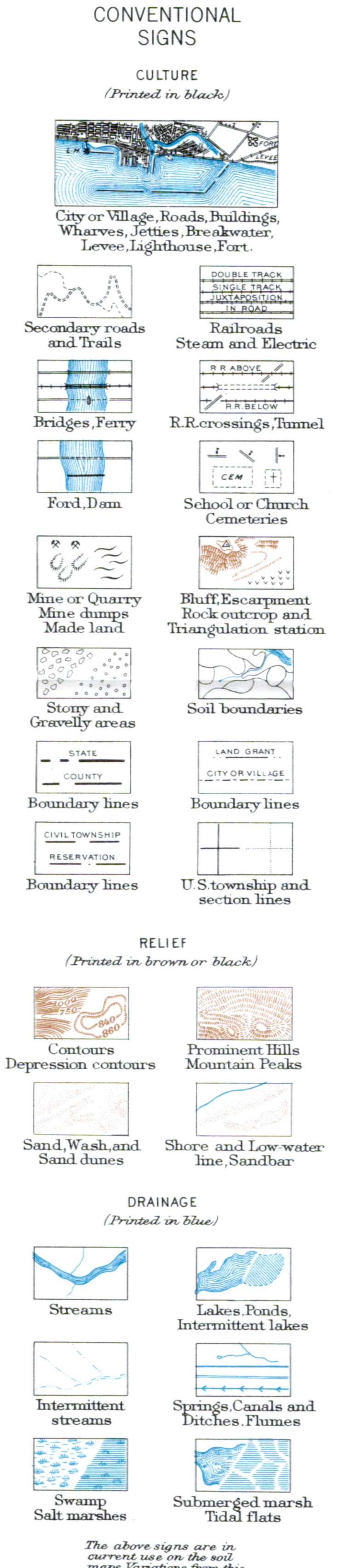
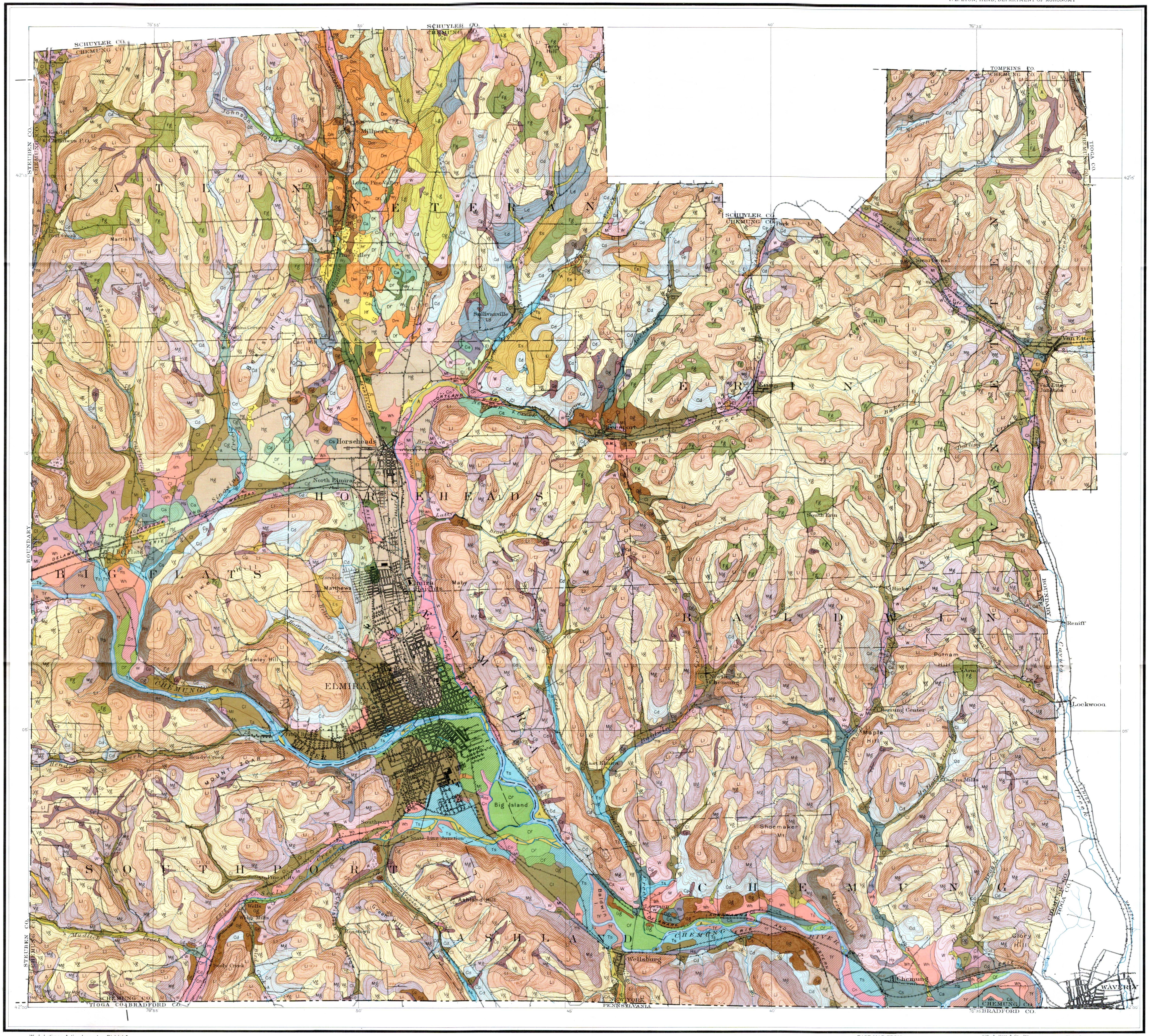
U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
HENRY G. KNIGHT, CHIEF
A. G. McCALL, CHIEF, SOIL INVESTIGATIONS
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
CHEMUNG COUNTY
NEW YORK

CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION
C. E. LADD, DIRECTOR
T. L. LYON, HEAD, DEPARTMENT OF AGRONOMY





LEGEND

- Caneadea silt loam — Ca
  - Poorly drained phase — Ca
- Dunkirk silt loam — Dm
  - Steep phase — Dm
- Middlebury silt loam — Ml
- Otisville gravelly loam — Og
- Canfield gravelly silt loam — Cd
  - Steep phase — Cd
- Eel silt loam — El
- Erie gravelly silt loam — Es
- Tioga fine sandy loam — Tf
  - High-bottom phase — Tf
- Chagrin fine sandy loam — Cf
  - High-bottom phase — Cf
- Fremont gravelly silt loam — Fg
- Groton gravelly loam — Gg
- Tioga silt loam — Ts
  - High-bottom phase — Ts
- Chagrin silt loam — Cn
  - High-bottom phase — Cn
- Holly silty clay loam — Hs
- Howard fine sandy loam — Hf
- Volusia gravelly silt loam — Vg
  - Steep phase — Vg
  - Shallow phase — Vg
- Chenango gravelly fine sandy loam — Cs
- Howard gravelly loam — Hg
- Chenango gravelly loam — Cg
- Langford gravelly silt loam — Ld
- Wayland silty clay loam — Wy
- Chenango gravelly silt loam — Cl
  - Alluvial-fan phase — Cl
- Lansing gravelly silt loam — Lg
  - Steep phase — Lg
- Unadilla silt loam — Wh
- Wooster gravelly silt loam — W
  - Steep phase — W
- Chippewa gravelly silty clay loam — Cp
- Lordstown stony silt loam — Ll
  - Steep phase — Ll
- Dunkirk fine sandy loam — Df
  - Steep phase — Df
- Alluvial soils (*Undifferentiated*) — A
- Mardin gravelly silt loam — Mg
  - Steep phase — Mg
- Carlisle muck — Cm
- Rough stony land (*Lordstown material*) — Rs

W. J. Latimer, Acting Inspector, District 1.
Soils surveyed by C. S. Pearson, in charge, and W. W. Reitz, John Mack, Ward Ellsworth and James Schwartz, Cornell University Agricultural Experiment Station.

Scale $\frac{1}{62500}$

1 ½ 0 1 2 3 4 Miles

1 ½ 0 1 2 3 4 5 Kilometers

Contour interval 20 feet

Datum is mean sea level.

BASE MAP FROM
U. S. GEOLOGICAL SURVEY SHEETS

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Field Operations
Bureau of Chemistry and Soils
1932